

# SCIENCE

NEW SERIES.  
VOL. VI. No. 157.

FRIDAY, DECEMBER 31, 1897.

SINGLE COPIES, 15 CTS.  
ANNUAL SUBSCRIPTION, \$5.00.

## New Scientific and Philosophical Books.

### SOCIAL AND ETHICAL INTERPRETATIONS IN MENTAL DEVELOPMENT.

A STUDY IN SOCIAL PSYCHOLOGY.

By JAMES MARK BALDWIN,

*Professor in Princeton University, Co-Editor of The Psychological Review.*

*Work crowned with the Gold Medal of the Royal Academy of Denmark.*

12mo. Cloth. Price, \$2.60 net.

### BY THE SAME AUTHOR. THE PRINCIPLES OF MENTAL DEVELOPMENT IN THE CHILD AND THE RACE.

METHODS AND PROCESSES.

12mo. Cloth. Price, \$2.60 net.

"One's abiding impression of the book is very favorable. Its pages breathe something of the intimacy, the frankness, the personal charm of a clever investigator's note-book."  
—*The Nation*.

### ETHICS.

By WILHELM WUNDT,

*Professor of Philosophy in the University of Leipzig.*

Vol. I. **AN INVESTIGATION OF THE FACTS AND LAWS OF THE MORAL LIFE.** Translated by JULIA GLOVER, Professor of Philosophy in Rockford College, and EDWARD BRADFORD TITCHENER, Sage Professor of Psychology in the Cornell University.

8vo. Cloth. Price, \$2.25 net.

Vol. II. **ETHICAL SYSTEMS.** Translated by MARGARET FLOY WASHBURN, Wells College.

Cloth. 8vo. Price, \$1.75 net.

### PRACTICAL IDEALISM.

By WILLIAM DE WITT HYDE, *President of Bowdoin College, and author of "Outlines of Social Theology."*

Cloth. Crown 8vo. Price, \$1.50.

The natural sequence of Dr. Hyde's Theoretical "Outlines," which was pronounced "a peculiarly original, interesting, and suggestive study."—*The Church Standard*.

### THE AMERICAN HISTORICAL REVIEW.

J. FRANKLIN JAMESON, *Professor of History in Brown University, Managing Editor.*

Single number, \$1.00. Annual Subscription, \$3.00. Issued quarterly. Vols. I. and II., bound in half morocco, \$4.00 net. Send for circular showing the contents of these volumes.

Send in your subscription for the new year, beginning with the October number, to

**THE MACMILLAN COMPANY, 66 Fifth Ave., New York**

### THE CONCEPTION OF GOD.

A PHILOSOPHICAL DISCUSSION.

By JOSIAH ROYCE, Ph.D.,

*Harvard University;*

JOSEPH LE CONTE, M.D., LL.D., and

G. W. HOWISON, LL.D.,

*Professors in the University of California.*

*A reissue with a new and fuller essay by Professor ROYCE.*

Cloth. Crown 8vo. Price, \$1.75 net.

### CHRISTIANITY AND IDEALISM.

THE CHRISTIAN IDEAL OF LIFE IN ITS RELATIONS TO THE GREEK AND JEWISH IDEALS AND TO MODERN PHILOSOPHY.

By JOHN WATSON, LL.D.,

*Professor of Moral Philosophy in Queen's University, Kingston, Canada.*

*New Edition with Additions.*

12mo. Cloth. Price, \$1.75 net.

In the present edition of this work, the second part has been enlarged by the addition of three new chapters (eighth, ninth, and tenth) and the intercalation of a dozen pages in the last chapter of the book. The eighth chapter seeks to exhibit the inadequacy of Materialism by showing that the Atomism upon which it rests is inconsistent both with science and with philosophy, and that in its struggle to reach consistency it accomplishes its own euthanasia.

### THE SOCIAL TEACHING OF JESUS.

AN ESSAY IN CHRISTIAN SOCIOLOGY.

By SHAILER MATTHEWS,

*University of Chicago.*

Cloth. Crown 8vo. Price, \$1.50.

"The author is scholarly, devout, awake to all modern thought, and yet conservative and pre-eminently sane. His style is fresh, his illustrations illustrate, and for most of his statements he gives Scriptural warrant by the citation of proof texts."—*The Congregationalist*.

## RARE MINERALS.

**THAUMASITE**, from Paterson, N. J., a sulphate, silicate and carbonate of calcium, pure white, 25c.

**EKDEMITTE**, bright yellow on red wulfenite, Arizona, 50c.

**NATIVE ARSENIC**, Japan,  $\frac{1}{4}$  to  $\frac{3}{4}$ -inch crystallized balls 25c, 35c.

### Collections for Schools.

**ALPHA COLLECTION**, twenty-five specimens in trays, contained in a neat wooden box and accompanied by a 16-page guide book (XIII., Guide for Science Teaching, Boston Society of Natural History), Price, complete, \$1.00.

**CABINET COLLECTIONS**, 100 specimens, small size, \$3.00. 100 specimens, large size, \$10.00. These specimens are each accompanied by a label giving name, system of crystallization, chemical formula, and locality, and make a good working collection for a student.

**EXCELSIOR COLLECTION** for high schools and colleges, 200 specimens, nicely mounted on wooden blocks, with beveled fronts for receiving labels. Price, packed, \$100.00. *School Bulletin* just out.

### Loose Crystals.

Small packages of free crystals for crystallographic study may be sent for inspection by mail at small cost. Approval boxes of cabinet specimens by express or freight.

## ROY HOPPING,

MINERAL DEALER,

5 and 7 Dey Street, NEW YORK.

### Important Sale of Rare Minerals.

A great opportunity is afforded to universities, museums and collectors, also others, of purchasing by private contract and in its entirety, the large and valuable collection of minerals known as the "Carne Museum of Penzance," Cornwall. This collection has been pronounced by experts to be one of the finest in the United Kingdom. It was commenced in the early part of this century, and has been in possession of members of the family of the founders ever since. The specimens, many thousands in number, are in splendid condition—many being quite unique. For full particulars, address OWNER, care of Street & Co., 30 Cornhill, London.

### NEW CATALOGUE.

We have recently issued a new edition, revised and enlarged to 64 pages, of our catalogue of

### Books on Chemistry, Chemical Technology and Physics.

It is arranged by subjects, and includes all the standard books in Chemical and Physical Science, as well as the recent literature up to date.

A copy of this Catalogue will be sent free by mail to any address.

## D. Van Nostrand Company,

Publishers and Importers of Scientific Books,

23 Murray St. and 27 Warren St., New York.

Dec. 1, 1896. Just Published. Sixth Edition of

## THE MICROSCOPE AND MICROSCOPICAL METHODS,

By SIMON HENRY GAGE, Professor of Microscopy, Histology and Embryology in Cornell University and the New York State Veterinary College, Ithaca, N. Y., U.S.A. Sixth edition, rewritten, greatly enlarged, and illustrated by 165 figures in the text. Price, \$1.50, postpaid.

COMSTOCK PUBLISHING CO., Ithaca, N. Y.

# Exhaustion

## orsford's Acid Phosphate.

Overworked men and women, the nervous, weak and debilitated, will find in the Acid Phosphate a most agreeable, grateful and harmless stimulant, giving renewed strength and vigor to the entire system.

Dr. Edwin F. Vose, Portland, Me., says: "I have used it in my own case when suffering from nervous exhaustion, with gratifying results. I have prescribed it for many of the various forms of nervous debility, and it has never failed to do good."

Descriptive pamphlet free on application to  
Rumford Chemical Works, Providence, R. I.  
Beware of Substitutes and Imitations.

For sale by all Druggists.

## HOUGH'S "AMERICAN WOODS"

A publication illustrated by actual specimens.

### WOODS FOR THE STEREOPTICON

Enabling you to show upon the screen characteristic structures projected from nature itself.

### WOODS FOR THE MICROSCOPE

Sections 1-1200 in. thick showing three distinct views of grain under each cover glass.

### WOOD SPECIMENS FOR CLASS USE

Nothing equals these for use in the class-room.

### VIEWS OF TYPICAL TREES

From Nature, photographs and stereopticon views.

### WOODEN CROSS-SECTION CARDS

Perfectly adapted to printing (with type or steel plate), painting, India ink work, etc.

If you are interested in wood or trees in any way send for our circulars and sample specimens.

Address R. B. HOUGH, Lowville, N. Y.

### For 12 Cents



I will mail a finely finished original photo, cabinet size, of Sioux Indian Chief, SITTING BULL, with his Signature. Have 200 subjects, all different, of leading Western Indians.

First-class work. Cabinet Size for 10 cents each. Some sent on selection. Give reference. After seeing sample you will want others. Indian Costume, Ornaments and Weapons. 15,000 Flint Stone Ancient Indian Relics. 100,000 Mineral and Fossil Specimens. Catalogue for stamp. 12th year.

L. W. STILWELL, Deadwood, South Dak.

# SCIENCE

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; J. LE CONTE, Geology; W. M. DAVIS, Physiography; O. C. MARSH, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoology; S. H. SCUDDER, Entomology; C. E. BESSEY, N. L. BRITTON, Botany; HENRY F. OSBORN, General Biology; C. S. MINOT, Embryology, Histology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; J. McKEEN CATTELL, Psychology; DANIEL G. BRINTON, J. W. POWELL, Anthropology.

FRIDAY, DECEMBER 31, 1897.

TIME WASTED.

## CONTENTS:

Time Wasted: M.....	969
Gardiner Greene Hubbard.....	974
On the Origin and Age of the Relic-bearing Sand at Trenton, N. J.: ROLLIN D. SALISBURY.....	977
Sanarelli's Work upon Yellow Fever: EDWIN O. JORDAN.....	981
Ludwig Rütimeyer: RUD. BURCKHARDT.....	985
Current Notes on Physiography:— The Glacial Lake Agassiz; Volcanoes of North America; Lakes in High Mountains; The 14,000 Maldiv Islands: W. M. DAVIS.....	985
Current Notes on Anthropology:— Elements of Melanesian Art; The Extension of the Arawack Stock; The Alleged Sumnerian Lan- guage: D. G. BRINTON.....	987
Scientific Notes and News:— The Winter Meetings of the Scientific Societies; The Eclipse Expeditions from Great Britain; General.....	988
University and Educational News.....	993
Discussion and Correspondence:— The Behring Sea Conferences: P. L. SLATER. The Enchanted Mesa: F. W. HODGE. La- marck and the Perfecting Tendency: JOHN GAR- DINER. Memorial Meeting commemorative of Allen and Horn.....	994
Scientific Literature:— Memorials of William Cranch Bond: TRUMAN HENRY SAFFORD. Hann's Handbuch der Klima- tologie: FRANK WALDO. The Theory of Solu- tions: H. C. J. Untersuchungen über das Er- friren der Pflanzen: D. T. MACDOUGALL.....	997
Societies and Academies:— Boston Society of Natural History: SAMUEL HENSHAW. The Torrey Botanical Club: ED- WARD S. BURGESS. Academy of Sciences of St. Louis.....	1003
New Books.....	1004

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

To what extent are men of science responsible for the credulity which everywhere prevails in reference to all matters relating to scientific discovery or accomplishment? This question is not to be lightly set aside, for the existing condition may well create alarm among all who seriously consider the welfare of science, of scientific men and of the people generally. Several causes have conspired to bring about this condition, two or three of which may be mentioned. To begin with, during the century which is now approaching its end scientific discoveries and their applications have been so numerous and so far reaching as to practically revolutionize conditions of material existence, and they have often been so wonderful in character that it ought not to excite surprise to find intelligent people ready to accept without question announcements of inventions and discoveries of the most improbable and absurd character. Along this line the evil influence of a sensational press is enormous. It was bad enough ten years ago, but it has been greatly magnified by the recent and, on the whole, unfortunate cheapening of processes of illustration to the seductions of which nearly every news-

paper in the land has yielded. To this has been added the newspaper 'syndicate,' by which men who know really nothing of science are employed to furnish sensational articles on scientific discovery, illustrated by sensational pictures, all of which is the more injurious because often founded upon a slender, microscopic tissue of fact. Unfortunately, some men who may be said to inhabit the fringe of genuine scientific activity lend themselves to this sort of thing and are made much of accordingly. Whole pages of this modern journalism are filled with accounts of discoveries that *are going to be made*, for writers of this class are shrewd in taking advantage of the fact that human interest and human memory are now practically restricted to about twenty-four hours in time. The publication of a broadside describing an alleged improvement of the telescope or microscope, in which there is absolutely nothing new that is true or true that is new, adorned with a series of cuts largely imaginary and many of which have no relation to the subject-matter, has served the purpose intended when its author has received his pay from the 'syndicate' and when the syndicate has scored a triumph in what in these days is called 'enterprise.' Even the most conservative among men of science are made to appear as willing purveyors of sensationalism by what ought to be looked upon as an unwarranted and illegitimate use of the results of carefully conducted investigations, often before such results have received final consideration and approval at their own hands.

If all impressions made by this false popularization of science were to disappear in

twenty-four hours the evil would be greatly lessened, but unfortunately there are many very intelligent and thoughtful people, who ought to constitute the best support of scientific work, upon whom they are more lasting. To such the line separating the genuine accomplishments of honest scholarship from the output of sensationalism, which ought to be clear and sharp, is becoming very nebulous, and there is imminent danger of a revolt against the whole thing. The extent to which credulity has been carried was beautifully illustrated not long ago when a widely known scientific man amused himself and many friends by caricaturing, in the columns of one of our standard scientific journals, some of the phases of modern psycho-physics. So perfectly did the burlesque reflect the form and substance of some recent contributions to that science that it was immediately accepted as serious by the large majority of readers.

This suggestion leads us by easy descent, or ascent, to that large and growing region of pseudo-science, the cultivators of which are, for the most part, themselves honest. For the most part, I say, for it is difficult to believe that all of the persistent advocates of unadulterated nonsense are seriously in earnest. Honest or dishonest, they usually come upon us in much the same way and nearly always find converts in sufficient numbers to enable them to press their fallacious theories upon the public attention. Their appearance is generally sudden and unexpected, and although they have never been heard of in scientific circles before; although they have never done even a small bit of work which might entitle



them to a hearing, they generally begin with some, to them, trifling performance, such as upsetting the law of gravitation or disproving the rotundity of the earth. Such work ought to be harmless, but unfortunately it is not always so. A monthly journal published at the seat of one of our largest universities, not bearing the imprint of the university, however, devotes a large proportion of its space to the exploitation of the belief that the surface of the earth is concave and not convex, presenting in evidence experimental details and results which, if true, would be startling. Such publications as this demand and receive no further attention than the occasional filing away of a copy as a curiosity. Nevertheless, it calls itself a *Scientific Monthly* and 'the greatest scientific paper in America.'

Occasionally books, more dignified in character and appearance but equally unsound in doctrine, are issued, with the imprint of publishers of established reputation, and which seem, therefore, to require more serious consideration. Of this class, is a recent volume bearing the not inappropriate title 'Some Unrecognized Laws of Nature,' the authors being Ignatius Linger and Lewis H. Berens. It is a large, handsomely gotten-up octavo of over five hundred pages and its substitute is 'An Inquiry into the Causes of Physical Phenomena with Special Reference to Gravitation.' The largeness of the subject makes the reader a bit suspicious to start with, and this feeling is considerably enhanced by the first sentence in the preface, which is as follows: "At last, after years of patient plodding in dim regions, where the footprints are few and the

pitfalls many, the time has arrived when we are enabled to place before the world of science the first fruits of our exploration." A book with such a beginning means either a great deal or nothing at all, and in the present instance a brief examination of its contents suffices to show that the only message which it brings is the too common one of well-meaning men attempting to explain what they do not themselves understand and to overturn well-established principles of a science of which they appear to be quite ignorant, by the use of arguments and data the soundness of which they are utterly incapable of judging. It is really a rather ostentatious attempt to explain the fundamentals of physical science by men who seem to lack all training in methods of physical research; who show gross ignorance of the latest results of physical investigation, and who are, therefore, totally unfit for the task which they have undertaken. A few citations and examples of their methods and conclusions will furnish sufficient defense for this statement.

They declare that the four great fundamental and universal laws of matter are 'persistence, resistance, reciprocity and equalization, each one of which,' they say, 'can be seen at work in every single phenomenon within our reach.' Their attack upon the Newtonian law of gravitation consists of the assertion that attraction is not proportional to mass, and this side by side with the equally emphasized assertion that the term 'mass' conveys no distinct idea and that we have really no notion of what it means. This, of course, is mere play, and would be unworthy of comment if it were

not followed by the declaration that the *weight* of a body can be and is changed without changing its mass, some curious experimental evidence being furnished to prove this. The conservation and dissipation of energy are denied and the splendid researches of Kelvin and Joule are overhauled and denounced by critics who declare that "Pressure is 'work' and so is motion." It is declared that Joule could not have obtained the same result for the mechanical equivalent of heat had he used mercury instead of water, and still less had he used friction on copper, iron, glass or wood, even though the 'work' expended were the same. Here the authors seem to be troubled by some sort of a notion of specific heat, and throughout the whole discussion the reasonably well-informed reader cannot fail to be astonished at the unparalleled density of honest ignorance. Their own idea of heat is that it is 'merely a state or quality of bodies, which can be augmented or diminished, and which is due to the states of coercion, *i. e.*, when bodies are prevented from satisfying their natural tendencies.' Their right to speak authoritatively on this subject is further exemplified in the remark that in the case of a falling body "the amount of heat generated will vary as the bodies striking against each other are harder. A quantity of water or mercury falling from a certain height would not generate as much heat as would a like quantity of, say, steel falling from an equal height." Some notions about electricity are reflected in the statement that thin wires offer less resistance than thick wires of the same material, and the further statement,

not altogether consistent with this, that the resistance of six pounds of copper would be the same, whether only a yard in length or a mile; also in the statement that the "air between two poles of an electro-magnet can be excited sufficiently to be felt as a viscous fluid when a piece of metal is passed to and fro between the poles."

The extension of some of these unrecognized laws into the domain of astronomy affords the authors ample opportunity for the display of their peculiar logic. In the case of the earth the whole thing is very simple. Its axial motion is due to relative states of excitation of its two hemispheres divided meridianally; the motion of the vanes of a radiometer and of plants turning to the sun is sufficient evidence of this. Its change of seasons is due to a reciprocating motion originating in the relative states of excitation of the two hemispheres, divided equatorially, and its varying distance from the sun is another reciprocating motion due to variations in the aggregate state of excitation of the whole mass. The revolution of the earth about the sun is a simple phenomenon, due to the rolling of one sphere upon the circumference of another. the necessary assumption that the real diameter of the whole earth must be over 500,000 miles being no obstacle to the acceptance of so beautiful a hypothesis.

It is, perhaps, in their review of the Newtonian law of gravitation that the authors reach a maximum in their phenomenal incapacity for an intelligent discussion of the subject. They assume to disprove that law by asserting that according to it the attraction at the equator ought to be greater than

at the poles; they try to support this assertion by reference to what they call 'another phenomenon, namely, that bodies taken down mines weigh less than when on the surface,' which is not true, as they could have known by even a brief study of gravity before undertaking to upset its accepted principles. They positively declare that two pendulums of different material made to agree in period of vibration at one point on the surface of the earth would *not* agree if carried to others, and, what is more extraordinary, they even suggest this as an *experimentum crucis* by which their theory may be tested. They are blissfully ignorant of the fact that this experiment has been tried many times in many parts of the world and that it has always gone against them, as in the nature of things it must.

It may now well be asked, is time so plenty, is other occupation so scarce and are the columns of SCIENCE so little in demand as to justify so much attention as this book has already received? Perhaps time and space are wasted, but some justification may be found in a few facts, one of which has already been alluded to—the book bears the stamp of a publishing house of the highest character and it has received lengthy and, on the whole, complimentary notice in recognized scientific journals. There is about it something of an air of scholarship calculated to impress and in some degree impose upon those who may be unable to detect its fallacies. There is considerable internal evidence to show that its authors are much more at home with metaphysics than with physics, although this may not be admitted by our brethren

of that ilk. Finally, it is perhaps well to make an opportunity for emphasizing the fact that no man has a right to undertake such a discussion as this book pretends to be until he has qualified himself by an exhaustive study of the principles which he proposes to attack. No man has a right to ask the ear of men of science or of an intelligent public on matters relating to science until he has demonstrated his own ability to understand and conduct a scientific investigation, by the presentation of actual, approved work. At first blush it would seem that these men are entitled to pity and sympathy rather than harsh criticism. They richly deserve both, and especially the latter, when their pages abound in the statement that men of science are so restrained by tradition and authority that they do not expect them to receive anything new with favor. This is an old, worn-out plea and utterly inapplicable at the present time. Students of science were never so willing as now to give attention to new theories, however revolutionary they may be, and they do not always insist that they should be immediately supported by facts, provided they emanate from one whose recognized accomplishments are such as to give reasonable assurance that he knows what he is talking about. If the authors of 'Some Unrecognized Laws of Nature' will now spend as much time as they have already spent in making the book in a serious attempt to study and understand some of the recognized elementary principles of physical science, the twentieth century may listen to them, if by that time they have anything to say.

M.

## GARDINER GREENE HUBBARD.

IN 1883 Gardiner Greene Hubbard and Alexander Graham Bell founded this JOURNAL. It was first published at Cambridge by Moses King, and its first editor was S. H. Scudder. The magazine was designed to be a means of communication between scientific men of America as a bearer of scientific news, an agency for the announcement of scientific discoveries and a forum for scientific discussion. It was not intended as a business enterprise, but it was hoped to establish it on a sure foundation as a gift to American scientific men. The death of Mr. Hubbard was announced in the last week's issue. As one of the original board of directors for the JOURNAL it may be appropriate for us to recount some of his achievements in the interests of scientific affairs.

Mr. Hubbard was born in Boston on the 25th of August, 1822. He came of a scholarly ancestry, his father, Samuel, being an alumnus of Yale, and a Doctor of Laws from Yale, Dartmouth and Harvard, an accomplished lawyer, and a member of the Supreme Court of Massachusetts. The family is English, its first representative in America being William Hubbard, a graduate of Harvard in 1642 and known as an early historian of New England. Mr. Hubbard himself was graduated at Dartmouth in the class of 1841, studied law at Cambridge, and was admitted to the bar in 1843, when he entered the office of Benjamin R. Curtis and remained with the firm until Mr. Curtis was elevated to the Supreme Bench of the United States. Mr. Hubbard continued to practice his profession in Boston for more than twenty years, and subsequently in Washington for five years. The degree of Doctor of Laws was conferred on him by Dartmouth and by Columbian University. His career as a lawyer was eminently distinguished, although it terminated twenty years ago, at

which time he was drawn into more active public life.

It is not Mr. Hubbard's legal experience of which we shall speak, but of the rôle which he played in certain public affairs and for which he will long be remembered. In 1860 he was led by the result of a severe illness in one of his children to investigate the possibility of teaching the deaf to speak. At this time there were two systems of instruction for deaf children prevailing in Europe—gesture language and oral speech.

In 1803 Francis Greene, a merchant of Boston who had a deaf child, thus became interested in the education of the deaf and made some study of the oral system. A memorial tablet has just been erected to Greene in Boston. In 1844 Horace Mann went to Europe and made a special study of the subject as it was practiced in Germany, and on his return attempted to introduce the system in America. About the same time the philanthropist Howe, who was the teacher of Laura Bridgeman, became interested in the same subject. An account of the case was published by the Smithsonian Institution. During this epoch the wife of Governor Lippett, of Rhode Island, whose child was deaf, attempted to teach the oral method, and about the same time Mr. Hubbard, whose little daughter had been rendered deaf by severe illness, became interested in oral speech, and by him Miss Rogers was induced to open a school of this character at Chelmsford, near Boston. Mr. Hubbard advertised for pupils for her school and supported it with his own means. The pupils here assembled made rapid progress, when Mr. Hubbard applied to the Legislature for a charter for the school. In the first instance it was refused; the chairman of the committee, himself having a deaf child, was the champion of sign language. Mr. Hubbard was not discouraged; he still pressed the subject on the public and enlisted those who



were especially interested in it by calling attention to the pupils of Miss Rogers' school, one of whom was his own daughter. He again applied to the Legislature for a charter and took the pupils of the Chelmsford school to the State Capitol and gave the committee a demonstration of the utility of the method. At about the same time he also induced Mr. Dudley to permit his child to visit Miss Rogers' school, and she became domiciled for a time at Miss Rogers' residence. In a few weeks Mr. Dudley visited his child, and when he appeared the little girl ran to her father and called him 'Papa.' He found that she was able to converse with him, being able to speak a few words and to understand a few when spoken by Mr. Dudley by interpreting the movements of his lips; thus Mr. Dudley became a champion of oral speech, and when the subject was again presented to the Legislature he made an eloquent appeal for a charter for the school. At this juncture a gentleman named Clarke offered a sum of money for the endowment of such a school to be located at Northampton; the benefaction was accepted by the Legislature and the charter was granted. Miss Rogers' school was transferred to Northampton, Mr. Hubbard himself becoming the president of the board of trustees, on which board he continued until his death. Thus was the teaching of speech to deaf children permanently and officially introduced into the United States.

The deaf constitute quite a large class of persons in modern society who have been rescued from a cheerless state by the efforts of philanthropic men. This class of the population had previously been condemned to a state of inactivity and dependence. In future years it will be difficult to appreciate the dreary life of the deaf as it appeared in youth to those who are now passing away with old age. Deprived of the means of intellectual culture, they seemed to be

stricken with a paralysis of reason and to wander as useless burdens on society. Instruction in speech has transformed them into helpful independence, so that the deaf may now bear an integral and honorable share in the society of their fellow-men, taking a part in the activities of modern life where the sweet music of speech makes glad the soul. Mr. Hubbard did not invent oral speech, but he became the leader of the men who developed the agencies by which oral speech has become the means of communication among a class of persons who were formerly mutes and who therefore took no part in the arts, industries, institutions and intellectual activities of mankind, while now they may be active, useful and happy members of society.

The student of men as they are engaged in human development may derive a lesson of great interest concerning the interdependence of demotic activities. Arts, industries, institutions, languages and opinions are developed in such a manner that one of these realms cannot be developed without the others. So, for example, a man without institutions is more dangerous than a wolf. In the same manner the investigator as a scientific man engaged in the pursuit of knowledge must depend on the inventor engaged in the application of knowledge, who in turn is dependent on the man of affairs for the utilization of his inventions. To designate this particular class of persons the English language gives us no term. Etymologically the word 'undertaker' is appropriate, but it has been used to designate a director of funerals. The French language has the term *entrepreneur*. Mr. Hubbard was the *entrepreneur* of scientific inventions and discoveries—the man of affairs who pushed them into the service of mankind. He was the *entrepreneur* of oral speech for the deaf, for he introduced it into all of the institutions of America designed to ameliorate the



condition of this class. Men without language are imbecile, as men without institutions are anarchists; but men with language are useful and happy members of the community, as men with institutions are self-respecting citizens.

As a lawyer, business man and benefactor Mr. Hubbard had acquired national reputation, when, in 1876, President Grant appointed him chairman of a special commission to investigate the question of railway mail transportation. The labors of this commission have greatly promoted the intercommunication of the people throughout the Union, for the plans of the commission were adopted by a succession of Postmasters-General and formulated into statutes by members of Congress. The results of his work did not end in national statutes and administrative devices, for he pursued it among telegraph companies.

When Mr. Hubbard was engaged in providing speech for his daughter and then expanding his energies into providing for all the deaf of the nation he naturally became interested in the science of acoustics, and this led him into association with a young student of the science who had already become an inventor. Alexander Graham Bell had so investigated the principles of acoustics that he could invent a telephone. In this instrument Mr. Hubbard evinced a deep interest. It was an instrument to make the inaudible audible, as the microscope was designed to make the invisible visible. At first it was supposed that it might be useful in communicating between different rooms in the same building or between adjoining buildings; but Mr. Hubbard saw in it an instrument of communication for all the governmental departments of a city, all of the business institutions of the city, and all the people of a city. More than this, he conceived that it might be the means of communication from town to town and city to city through-

out the country, finally to become a means of international communication. For this purpose Mr. Hubbard devised the business machinery for the introduction of the telephone to the world. He organized a company for this purpose and managed the company by business devices with a great central company and a multitude of local companies by which the telephone business was introduced into all portions of the civilized world. Now a man can be put in communication with his baker through the telephone; in the next minute he may be put in connection with a railroad office or a steamship company; at the next minute with the Governor of his State; at the next minute with some other man elsewhere in the world. To accomplish all this has taken many years of intelligent active labor. Before this we could communicate with the world by lightning light; now we can communicate with the world by lightning sound. The man who devised all this business machinery, set it into operation, and made it all a business success, was Mr. Hubbard.

Mr. Hubbard was not the discoverer of the laws of acoustics which are represented in the telephone; he was not the inventor of the telephone, but he was the *entrepreneur* who distributed the telephone among all men of the civilized world and made it a practical agency for social intercommunication. Having accomplished all these things he retired from business and made his home at Twin Oaks, in Washington City.

At the seat of the federal government there are many bureaus that have to deal with the science of geography. First, there is the time-honored bureau known as the Coast Survey, which is charting the coasts of the sea as an aid to the mariner; then there is the Geological Survey, which is making maps of the United States in the interest of mining and manufacturing;

then there is the Weather Bureau, which is making a daily map of the heavens to exhibit the temperature and storms of the land in the interest of commerce and agriculture; then there is a Hydrographic Bureau preparing charts of all the seas in the interests of foreign commerce. In addition to these great geographical bureaus there are many others that are necessarily interested in geography. Thus, the General Post Office must prepare maps of postal routes. Now the little army of men who are engaged in geographical work in Washington organized themselves into a body known as the National Geographic Society. When they were duly organized they cast about for some one who could manage their affairs as its president and who would interest himself in the diffusion broadcast among the people of this geographical knowledge, which all these bureaus were acquiring. The man selected for this purpose was Gardiner Greene Hubbard, who was elected its first president.

The function of the National Geographic Society is the discussion of the principles of geography and the diffusion of geographical knowledge among the people. To carry out this purpose Mr. Hubbard organized a journal called the *National Geographic Magazine*, which has already acquired a good circulation and become an influential publication. Then he organized a system of bulletins designed to discuss the elements of physiography as a compendious library for teachers in the public schools, and finally he organized in the city of Washington a system of public lectures on geography, enlisting not only the members of the Society, but many other able public men in this enterprise. In all of these agencies the working geographers of Washington most heartily cooperated, and the National Geographic Society has within very few years attained an influence and efficiency which is unequalled in America

and perhaps in the world. Thus Mr. Hubbard was the *entrepreneur* of geographical knowledge.

Investigation and discovery lead to useful, honorable and glorious careers, but knowledge must result in invention if it becomes useful, and inventions themselves must be applied to public affairs if they are to be a boon to mankind.

Mr. Hubbard died at three o'clock on the 11th of this month, loved by his kindred, beloved by his friends and honored by the world.

ON THE ORIGIN AND AGE OF THE RELIC-BEARING SAND AT TRENTON, N. J.\*

THE locality where human antiquities have recently been found near Trenton, New Jersey, is situated about two miles south of the heart of the city. The points where the finds are being made are on a somewhat extensive plain, the principal formation of which is composed of the sand and gravel deposited by the glacial drainage which came down the Delaware during the last glacial epoch. On the east side of the Delaware the plain extends about two miles east of the locality where the finds are made. It also has a considerable development on the west side of the river, and extends many miles up and down the Delaware north and south of the locality in question. From Trenton it also stretches northeast a number of miles along the Assanpink creek. In the vicinity of Trenton this plain has an elevation of 50 to 60 feet. Through it the Delaware has cut a wide valley, the flood-plain of which is now less than ten feet above sea-level. The relation of the flood-plain to the plain above shows that, after the latter was made, the river excavated a valley in it, cutting it down essentially to tide-level. This valley has been cut since the last glacial epoch.

\* Paper presented at the summer meeting of the American Association for the Advancement of Science.

The gravel plain to the east and north of the point where the finds are made ends abruptly at the margin of the post-glacial valley, in a bluff about forty feet in height, with a slope which is about as steep as the material of which it is composed will lie.

The relations shown on the New Jersey side of the river are in a general way duplicated on the Pennsylvania side. The gravel of glacial age has a similar disposition, but the border of the valley on that side is not so sharply defined, indicating that the more recent cutting of the stream has been on the east. The steepness of the bluff of gravel at the points concerned is in itself proof of the recency of the excavation on this side.

The surface of the plain is slightly undulatory, though the relief is usually but a few feet. In places erosion has affected it to some slight extent, and in places its surface appears to have been left slightly uneven by the deposition of the material of which it is made. Its surface is also characterized at various points by low mounds and ridges of sand heaped up by the wind. By this means an element of undulatoriness has been added to the surface as originally left by the deposition of the main body of sand and gravel involved.

While the plain consists of sand and gravel, so far as its general constitution is concerned, its surface is in many places coated with a thin layer of sandy loam, which contains occasional pebbles similar to those which make up the body of the gravel beneath. It is not always possible to say to what extent the surface loam represents the last stage of deposition of the glacial sands and gravel; to what extent it represents the surface accumulation of loamy matter brought up from lower levels by the action of biotic agencies, such as worms, ants, burrowing mammals, etc.; or to what extent it represents deposition by marine or estuarine waters which stood

over the region after the glacial drainage ceased to flow through this part of the Delaware.

Relations similar to those where the human relics just south of Trenton are found characterize the east side of the Delaware for many miles further south. In this direction materials derived from glacial waters are less readily identified at most points, but the topography and relations of the plain bordering the Delaware are such as to show that it was developed contemporaneously with the plain at Trenton. Even where not made up chiefly of glacial materials, the plain further south, like that at Trenton, is slightly undulatory, and is coated, in places, with dune sand. Such sand is especially likely to be found on the west edge of that part of the plain which lies east of the Delaware, and just east of the line where the plain descends with a bluff face to the flood-plain of the stream. Well-marked dunes sometimes appear in this situation, and dune sand in larger or smaller quantity is so general that its presence along the edge of the plain above the valley may be said to be the rule, rather than the exception, between Trenton and Camden.

The same is true of the tributaries which come down to the Delaware from the east. Although they did not bring down glacial sands and gravels, they brought down sands and gravels of other sorts, partially filling their valleys, which, like the Delaware, have been re-excavated since. On the bluffs of the tributary valleys, as well as along the main stream, dune sand is of frequent occurrence. In the dune sand along these tributaries, relics of early peoples, consisting of chips of argillite, arrow-heads, and half-fashioned tools of various sorts, are frequently found.

Sand is found in similar relations at some points on the Delaware above Trenton. At many points it has been blown up from the

glacial gravel terraces to higher levels, though it rarely takes the forms of distinct dunes. It is frequently three to five feet in depth, facing the bluffs above the glacial plain in irregular patches, or capping their crests.

The trenches in which the human relics near Trenton have recently been found are upon the immediate edge of the plain overlooking the post-glacial valley of the Delaware. Here, as is frequently the case in such situations, the sandy loam over the gravel of glacial age is thicker than farther back from the bluff, but even here it is but three or four feet in thickness, including the black soil. It is in this sand and loam, quite above the materials which are clearly of glacial age, that the human relics are found.

In detail the sections shown in the trenches open in May and July showed a sandy soil affected by organic matter to the depth of six to twelve inches, the lower limit being ill-defined. The soil graded down into sand which was essentially free from organic matter, and which had a thickness of two to three feet. The sand was without apparent stratification. Below it lay the stratified drift, confidently referred to the time of the last ice epoch. It will be seen, therefore, that the relics were found in the structureless sand and loam which overlay the sand and gravel of glacial age.

Besides being essentially structureless, the sand and loam in which the relics were found contained occasional pebbles. Some of them were as large as one's fist, and occasionally one was found of still greater size, though most of them were tiny pebbles. Many of them were so small as to be within the power of wind to transport, while others were so large as to make this mode of transportation impossible.

In the sand there were at some points streaks more highly colored than the por-

tions above or below. These streaks had a position approaching horizontality, but in detail they were exceedingly irregular. Locally they were interrupted, apparently broken; and in other places they faded out altogether. In general they were thin, a trifling fraction of an inch in thickness. They were sometimes so faint as to be traceable with difficulty, while in other places they thickened to a quarter of an inch or more. While these streaks were often distinct, they were not to be mistaken for lines of stratification, with which they clearly had nothing to do. They could not be assumed to be the edges of stratification plains distorted by unequal sinking, for if this were their origin successive streaks in the same vertical section should have corresponded in their irregularities. This was not the fact, for one streak was liable to bend up just where the one a few inches below it bent down, a relation which excluded the idea of unequal settling. Furthermore, they were so irregular that their total length, as seen in the face of a trench, measuring all irregularities, was considerably greater than the length of the section itself.

These reddish streaks, which were thought to carry more pebbles than the other portions of the sand, seemed to be due to one or more of two or three causes. In places they seemed to be due to the concentration of coloring matter, especially iron oxide. In other places they looked rather as if fine reddish silt had accumulated along them through the influence of percolating water. In either case there must have been something in the texture along this irregular surface to occasion the concentration. The surface of which these irregular lines were the outcrops may perhaps once have been the upper surface of the land, subsequently buried by wind-blown dust and sand. Many of the little irregularities of the streaks were such as might be thus explained, though



the abrupt breaks in them must be accounted for in some other way. So far as I could make out, there was nothing except these reddish streaks which could by any possibility be mistaken for structure, and had I not known at the time of my second visit that they had been taken by others for stratification plains, I should not have supposed this interpretation a possible one.

Concerning the age and origin of the sand which contains the relics, no positive affirmation can be made, and it is only fair to say that this statement is made on the basis of a somewhat full knowledge of the surrounding region. So far as its stratigraphic relations are concerned, the relic-bearing sand might represent the last phase of deposition by glacial waters, or it might belong to any later epoch. Its absence of structure does not show that it was not deposited by water, for in the nature of the case it could not now be expected to show structure, whatever its origin. This would be true whether it represents (1) the last phase of deposition by glacial waters, (2) an estuarine deposit of later age, or (3) eolian sand; for the continually renewed perforation of the sand to the depth of several feet by the roots of plants, the continual borings of burrowing mammals, worms and insects, all of which frequently go down to the bottom of the sand overlying the gravel of glacial age, would quite certainly have destroyed all traces of stratification which the sand may once have had. If this were not enough, the freezing and thawing, and the wetting and drying, would have completed the obliteration of any original structure. For this result even a very few centuries would suffice. It cannot be asserted, therefore, that the sand was not once stratified.

On the other hand, the sand in which the relics are found may have been blown to its present position. The fact that the immediate edge of the bluff is slightly higher than

the plain farther back lends color to this view, but the rise next to the edge of the bluff is very slight, and the conclusion that it is due, at this particular point, to an accumulation of wind-blown material is not necessitated. The explanation of eolian sand in this position would be easy. While the river was cutting its valley in the plain, the bluffs were bare. The bare face of the bluff was made of loose sand and gravel, and the prevailing westerly winds might well have blown sand from the slope to the top of the bluff above. This is just the situation in which dune sand would be expected to accumulate under such circumstances, is indeed just the situation in which it has accumulated at many other points along the Delaware and its tributaries. It is probably not exaggeration to say that dune sand occurs in greater or less quantity along the Jersey side of the river, more than half the way between Trenton and Camden, and throughout the stretch its favorite position is on the edge of the river bluff. The dune sand along the tributaries to the Delaware between Trenton and Camden occurs in the same relations. The very general presence in the region of wind-blown sand on the crests of valley bluffs leads one to suspect the same origin for sands in similar situations, such as that in which the relics are found, even when they cannot be proved to be eolian. The case is still further strengthened by the fact that human relics are very generally found in the sand which is demonstrably eolian.

In the presence of the stones there is an apparent difficulty in the way of ascribing the sands in question to the wind. If, however, the sands were accumulated by the wind after the occupation of the region by early peoples, the larger stones may have been dropped by men upon the surface at the same time with the argillite chips and half-fashioned implements, while the smaller ones might have been blown in. But we



are not shut up to this conclusion. There are various other ways in which pebbles might be introduced into eolian sand. The burrowing animals and the growth and decay of the roots of trees might introduce relics and stones from the top, if they were left by men on the surface. Relics of modern civilization, bits of coal, pieces of brick, etc., were found in the sand down to a maximum depth of seventeen inches. The uprooting of considerable trees might bring up gravel stones of considerable size from depths of several feet into the surface material. If forest trees were ever upturned by winds in this locality they could not fail to bring up pebbles into the sand above the gravel. The breaks in the streaks already referred to might find explanation in such disturbances. In view of these possibilities the presence of the pebbles in the sand cannot be asserted to prove that it is not of wind origin.\* Finally, it is believed that no unqualified conclusion concerning the origin of the relic-bearing sand is warranted. It may be of aqueous origin, dating from the close of the last glacial epoch; it may be of aqueous origin of later age, for sea water probably covered the region at the close of the last glacial epoch or later; and it may be eolian, dating from a time long subsequent to the deposition of the sand and gravel of the plain.

Whatever its origin, it may safely be said that the surface material down to the lowest depth at which the relics have been found has been so disarranged that no affirmation can be made concerning the origin of the pebbles and relics it contains. It is all within the zone of active weathering and surface disturbance. If the finds were

fossils, in the usual sense of the term, it is certain that geologists would not feel warranted in attaching much importance to them.

ROLLIN D. SALISBURY.

UNIVERSITY OF CHICAGO.

#### SANARELLI'S WORK UPON YELLOW FEVER.

At the request of the editor of SCIENCE I append a brief *résumé* of Sanarelli's recent papers upon yellow fever.\*

The most important study of yellow fever that appeared before Sanarelli's investigations were undertaken was that made in 1888-9 by Dr. Sternberg, whose researches led to an essentially negative result. Upon only one microorganism found by him in the course of his thoroughgoing investigations did any degree of suspicion fall, and the evidence against this germ was summed up by Sternberg as follows:

"Among the facultative anaerobics is one—my *Bacillus X*—which has been isolated by the culture method in a considerable number of cases and may have been present in all. This bacillus has not been encountered in the comparative experiments made. It is very pathogenic for rabbits when injected into the cavity of the abdomen.

"It is possible that this bacillus is concerned in the etiology of yellow fever, but no satisfactory evidence that this is the case has been obtained by experiments on the lower animals, and it has not been found in such numbers as to warrant the inference that it is the veritable infectious agent.

"All other microorganisms obtained in pure cultures from yellow fever cadavers appear to be excluded, either by having been identified with known species, or by having been found in comparative researches made outside of the area of yellow fever prevalence, or by the fact that they have

\* My co-laborer in New Jersey, Mr. George N. Knapp, visited the locality where the relics are found in June, and reached the conclusion that the sands in question are eolian. No one else has more intimate familiarity with these sands than he.

\* *Annales de l'Institut Pasteur*, June, September, October, 1897.

been found only in small numbers and in a limited number of cases."

Sternberg has recently called attention \* to the close similarity between his description of the 'Bacillus X' mentioned in the above quotation and the description of '*B. icteroides*' given by Sanarelli, and makes out a strong case for the view that the two are identical.

Sanarelli began his work in February, 1896, shortly after his appointment as Director of the Institute of Experimental Hygiene at the University of Montevideo. In 7 out of 12 autopsies made by him upon the bodies of victims of yellow fever there was found a specific bacillus (*B. icteroides*) which he regarded as hitherto undescribed. The reasons assigned for the failure of himself and others to isolate this microbe in all cases of yellow fever are: 1. That *B. icteroides* multiplies in the human body only to a limited extent, the complete and characteristic effects of the disease being produced by only a very small quantity of toxin. 2. That this toxin, whether directly or indirectly, facilitates to a remarkable degree secondary infection of all kinds. These secondary infections with the colon bacillus, streptococcus, staphylococcus, etc., may of themselves be fatal to the patient, and Sanarelli believes that the fatal termination or several cases observed by him is to be explained in this way. 3. That these mixed infections not only lead to the speedy disappearance of the specific microbe, but also frequently end by transforming the organism of the patient into a culture medium for almost all kinds of intestinal bacteria.

The bacteriological complications arising from these facts enhance considerably the technical difficulties of isolating the specific bacillus. Sanarelli did not succeed in finding the germ in the gastro-intestinal contents and is inclined to doubt if it usually occurs there at all; he did, however, dis-

cover it in the circulating blood and in some of the important organs of the body, notably in the liver. He refers to the prevailing belief that the infectious material in yellow fever is localized in the stomach and is to be sought for especially in the black vomit, but prefers, for his part, to regard the gastric disturbances as due to the selective action of the toxin, a view similar, it will be remembered, to his interpretation of the intestinal lesions of typhoid fever.

*Bacillus icteroides* grows readily upon the ordinary nutritive media, fluid and solid. It is described as a rod about  $2\mu$ – $4\mu$  in length, with rounded ends, often joined in pairs, and staining readily with the ordinary aniline dyes, but decolorized by Gram's method. The colonies upon a gelatin plate resemble in some particulars those of the colon bacillus, but never show any trace of the chestnut color developed in cultures of the latter; so-called pleomorphism of the colonies is, however, marked.

Contrary to what is true of most of the known pathogenic microbes, the growth of *B. icteroides* upon agar is especially characteristic and furnishes a diagnostic test of the first importance. If the cultures are allowed to develop in the incubator at  $37^{\circ}$  for from 12 to 24 hours, and are then transferred to a temperature of from  $20^{\circ}$  to  $28^{\circ}$ , there is produced what Sanarelli regards as a highly characteristic appearance. The growth at the lower temperature forms a sort of halo around the portion of the colony developed in the incubator, and this appearance is so singular that according to Sanarelli a mere superficial inspection suffices to distinguish immediately, and with the naked eye, a colony of *B. icteroides* in the midst of all other bacterial colonies yet described. As the growth goes on, an effect is produced as if a layer of opaque paraffin had been poured over the agar and then impressions made in it with a small circular seal, the imprints of this seal corresponding with

\* *Centralbl. f. Bakt.* I. Abth. XXII., Nos. 6 and 7.

the original transparent colonies grown in the incubator. The final aspect of the culture is compared to a miniature archipelago in which the islets would be represented by the colonies first developed, and the surface of the water by the layer subsequently formed at the lower temperature.

Blood-serum and potato proved themselves to be rather unsuitable media for *B. icteroides*. In milk the germ grows readily, but without producing coagulation. The most favorable fluid medium tested by Sanarelli was beef broth containing lactose and calcium carbonate.

The germ is pathogenic for most of the domestic animals. Mice, guinea-pigs and rabbits succumb readily to inoculation with a pure culture. The rabbit is considered as the most favorable subject for experimental inoculation, and possesses notable advantages over the guinea-pig both in susceptibility and in the regularity and constancy of symptoms and death. The dog, however, presents the most instructive instance of close analogy with the disease yellow fever as it manifests itself in man. Both in the symptoms and in the anatomical lesions Sanarelli was able to trace a correspondence at once constant and precise. As is the case in man, the liver and the kidneys are the organs especially attacked; secondary infections with the streptococcus and colon bacillus sometimes occur.

In the second memoir Sanarelli details the results of his experiments with the yellow fever toxin. Cultures of the germ 15-20 days old, made in ordinary peptonized meat broth and filtered through a Pasteur-Chamberland tube, afforded him a potent toxin. The toxin thus prepared, when injected into the bodies of susceptible animals, produced substantially the same symptoms as inoculation with the specific bacillus. In the dog, particularly, inoculation with the germ-free toxin set in motion the same train of specific symptoms and caused the same

pathological changes in the tissues. "The toxin of yellow fever is an exceedingly powerful cellular poison comparable solely, in some points, to the diphtheria toxin. Its contact with the tissue elements of the animal organism, especially the higher species, determines, like that of the diphtheria toxin, a violent irritation, followed by retrogressive processes which always end in the necrosis and fatty degeneration of the protoplasm."

Some very interesting experiments bearing on the question of mixed infection are next described. When *B. icteroides* is sown upon culture media on which, respectively, the colon bacillus, streptococcus and proteus have been previously grown, it is found that the growth of the former is distinctly inhibited by the presence of the soluble products of the other microbes. The latter, on the contrary, grow excellently in a medium previously inhabited by *B. icteroides*, and are only slightly incommode by the presence of the soluble products of one another, the products of the proteus bacillus seeming most injurious to all concerned. A similar result was revealed by a study of the 'vital antagonism' of *B. icteroides* and the microbes concerned in the secondary infections. Both *streptococcus pyog.* and *staphylococcus pyog. au.* speedily gain the upper hand over *B. icteroides*, and a similar, though less marked superiority, is manifested by the colon bacillus. These facts certainly shed much light on the difficulty of demonstrating the presence of the yellow fever germ in the bodies of victims of the disease, and go far to explain the negative result reached by many observers.

In an attempt to account for the important part played by maritime commerce in the diffusion of yellow fever Sanarelli records a curiously significant observation. It was noticed that gelatin plates sown with *B. icteroides* sometimes remained without development, although agar plates sown at the same time evinced abundant growth. But

if a colony of mould made its appearance on the gelatin plate, colonies of *B. ieteroides* immediately sprang up around it. After some days the colonies of *B. ieteroides* form a sort of constellation around the mould, the most abundant development taking place in the immediate neighborhood of the latter. This observation was experimentally verified with six species of moulds (not named) 'accidentally isolated' in the laboratory, all of which proved themselves, although in different degrees, capable of favoring the revivification and multiplication of the yellow fever germ. To this singular symbiotic relation Sanarelli is inclined to attribute the ready domiciling of the disease on shipboard and its connection with warmth, moisture and darkness, conditions which, by directly favoring the germination of moulds, indirectly favor *B. ieteroides*.

In some brief notes upon the resistance of the germ to physical and chemical agents it is stated that, by exposure of broth cultures to 55°, the germ is killed in about twenty minutes, and that it is instantly destroyed by a temperature of 65°. Dry heat at 110°-125° is speedily fatal, and exposure for one hour and ten minutes at 100° also suffices to destroy vitality. Considerable resistance is shown to desiccation, a result of evident practical importance. In sea water the bacillus shows great vitality, surviving in the sterilized brackish water of the La Plata for upwards of ninety days.

Sanarelli's third memoir is devoted to a consideration of immunity and serum therapy. The serum obtained from the bodies of yellow fever victims causes agglutination of *B. ieteroides*, although the intensity of the reaction is said to be quite variable. This serum does not exert any protective power in inoculated animals. Serum from a convalescent provoked a tardy agglutination and manifested a slight preventive power.

An attack of yellow fever in man confers

some degree of immunity against a second attack, and hence it would seem as if it might be possible in some way to vaccinate animals against the disease. Attempts to produce immunity in the rabbit failed on account of the excessive sensibility of this animal to the yellow fever virus, and the same difficulty prevented the use of the goat and the sheep. The work upon immunization was mainly limited, therefore, to experiments upon the guinea-pig, the dog and the horse. In all these animals immunization is an unusually difficult and laborious task. While it is possible to immunize a guinea-pig against cholera or typhoid fever in from two to three months, it needs six to seven months of assiduous and delicate work to vaccinate this animal against yellow fever. Dogs may be immunized somewhat more readily, but never become tolerant of large doses of toxin. Horses are treated first with small doses (5-10cc.) of a filtered culture of the germ injected subcutaneously, followed with intravenous injections. After two months of treatment with filtered cultures the more potent doses of cultures sterilized by ether may be used; it is not until five to six months after the beginning of the treatment that the first injection of a living culture may be safely hazarded. During this process of immunization many of the animals die and all are profoundly affected.

The serum of animals immunized in this way is endowed with protective and curative properties and can be used with success in animal experiments. A single instance may serve to illustrate the results obtained by this procedure. A horse under treatment for the space of nine months received subcutaneously during this period 29cc. of filtered cultures and 350cc. of cultures sterilized with ether, and intravenously 264cc. of sterilized cultures, 345cc. of living broth cultures and 19cc. of an agar culture. The serum (0.5cc.) from this



animal, when injected into a guinea-pig 24 hours before inoculation with several times the fatal dose, conferred immunity; 2cc. proved potent enough to save the lives of guinea-pigs when injected 48 hours after inoculation.

Sanarelli's work upon immunization was still in progress when the third memoir was written, and the outcome of his projected experiments in serum-therapy will be awaited with much interest.

EDWIN O. JORDAN.

LUDWIG RÜTIMEYER.

On the 25th of November, 1895, died at Basle Ludwig Rüttimeyer, the last survivor of a long series of Swiss naturalists, the representatives of the classic period of natural science in this country. Now, two years after the death of this distinguished naturalist, his miscellaneous papers appear in a form capable of attracting the attention of the scientific world.\* Rüttimeyer's numerous publications, which for a long time chiefly adorned the 'Abhandlungen der schweizerischen palæontologischen Gesellschaft' and the 'Denkschriften der schweizerischen naturforschenden Gesellschaft,' could not be reproduced, but the smaller occasional lectures and writings, which, owing to the astonishing universality of Rüttimeyer's researches and studies, deal with questions of zoology and anthropology as well as of geology and geography, are here collected in two volumes. It is well known what a high position the leader of European paleontology, von Zittel, has assigned, for example, to Rüttimeyer's paper on the geographical and geological distribution of animals. Whoever shall read this and the similar papers made accessible by this edition will be surprised by the perspicacity of the conclusions and the abundance of openings in every direction of

natural philosophy, the exceeding originality and the immense knowledge of details which characterized the man, to whom in the last decades, along with Sir Richard Owen, Vertebrate Paleontology in Europe is most indebted. Among the fundamental questions of zoology we find treated the principles of natural history, the boundaries of animal life, the phylogeny of the vertebrate skeleton, the changes in animal life in Switzerland since the presence of man, the modality of progress in the organic world, general considerations on the seclonic structure of Europe, history of glacier studies in Switzerland, three essays on the Bretagne and addresses in the memory of L. Agassiz, Ch. Darwin, P. Merian and B. Studer, who were in intimate relations with Rüttimeyer. The first volume is introduced by an autobiographical sketch, which may give to American naturalists an idea of the development, the many suggestions and difficulties of a Swiss who devoted his life to natural philosophy.

RUD. BURCKHARDT.

BASEL, December 1, 1897.

CURRENT NOTES ON PHYSIOGRAPHY.\*

THE GLACIAL LAKE AGASSIZ.

As the Monographs by Gilbert and Russell on the extinct Lakes Bonneville and Lahontan are the classics with regard to basins from which former bodies of water have been withdrawn by evaporation, so

\*In SCIENCE for December 3d it was implied that the recent report of the Maryland Geological Survey had neglected possible relations with the schools of the State and devoted its physiographic studies to the interests of 'those who may seek a home in Maryland.' This error was due to my eye having caught the heading 'Study of the Physiographic Features of the State' (p. 40), in which only the immigrant is referred to as taking advantage of the results; while I failed to note, under the heading 'Preparation of Final Reports,' a very explicit mention of their educational significance. "It is most desirable that the youth of Maryland should grow up with a knowledge of the country in which they live, and be

\* 'Gesammelte Schriften.' Basle, Georg et Cie. 1898.



Monograph XXV. on the Glacial Lake Agassiz, by Warren Upham (U. S. Geol. Survey, Washington, 1895) at once takes its place as a standard work regarding one of those remarkable water bodies which for a time flooded an area marginal to the retreating ice sheet. A great fund of detailed description is here added to the reports already published by Upham and others, regarding the Red river plain, outlets, shore lines, deltas, etc. It is important to note that large areas of the plain at its south end and along either side are mainly composed of unstratified till, and that only the medial part of the plain is covered by lacustrine silts. The plain, therefore, should be classified not only under lacustrine plains, but also under plains of till; the latter species being until recent years unmentioned in text-books. An intricate lacustrine history is revealed by the complicated succession of shore lines which varied with gentle epirogenic movements, and by the changes of discharge from the southern outlet to some more northern lines of overflow. Maps and views are liberally provided. As has been the case with many other phases of glacial study, it is remarkable to discover how largely the existing physiographic conditions of certain regions are dominated today by processes associated with glacial action. Yet until very lately our physical geographies gave practically no attention to land forms of glacial origin. This neglect cannot long continue in face of so fine a collection of examples as this great monograph contains.

able to interpret intelligently the physical features of the State." If the people of the State desire it, material adapted for purposes of public instruction will be provided in future volumes.

Having for some years believed that our State Surveys lost a valuable opportunity of serving the public good, and of gaining sound public support by their general neglect of relations with the public schools, I am glad now to make explicit correction of my former note on the Maryland Survey in this regard.

#### VOLCANOES OF NORTH AMERICA.

FOLLOWING the plan of his volumes on Lakes and Glaciers, Russell has completed a valuable work on the Volcanoes of America, 'a reading lesson for students of geography and geology' (Macmillan, 1897, p. 346, many plates). A third of the book is given to characteristics of volcanoes, presenting an excellent summary of the subject, excepting that 'erosion of volcanoes' is, for a geographical book, too briefly dismissed in four pages, as compared to thirty pages allotted to products of volcanic action. The descriptive chapters on the volcanoes of different districts summarize the results of our Western surveys, where Russell's own observations play no unimportant part, and abstract many accounts not generally accessible, such as those concerning the explosive eruption of Consequina, the building of Jorullo, the recent explorations of the lofty Mexican cones, and the surveys of the Alaskan islands. The dissected cones and heavy lava beds of the Yellowstone Park are not mentioned. A chapter of theoretical considerations explains the ascent of lavas from their deep sources chiefly as an escape from the pressure of the enclosing crust, and characterizes steam explosions as relatively superficial incidents instead of prime causes of eruption. A final chapter gives the life history of a volcano. The illustrations are numerous and excellent.

#### LAKES IN HIGH MOUNTAINS.

E. FUGGER has an article on *Hochseen* (Mitth. Geogr. Gesell. Vienna, XXXIX., 1896, 638-672), in which he gives especial attention to the small lakes occurring in the Karen (corries, cirques, amphitheatres) of the Salzburg Alps, the 'normal lakes' of high mountains. He discards the explanation by glacial erosion maintained by Böhm and many others, and Richter's modification of this explanation, where drift ob-

struction is called to the aid of simple excavation. After showing that corry lakes are true rock basins and that local deformation cannot account for them, Fugger advances the idea that they lie in funnel-shaped cavities that once led down to subterranean channels opened by solution, but now obstructed; even advocating this explanation in corries of crystalline rocks, and defending it by a rather elaborate physico-chemical argument.

Apart from the general difficulty of believing in the sufficiency of underground solution in resistant rocks, it seems impossible that erosion thus determined could exceed that effected by the active streams that descend the steep slope on the open sides of corries. As the problem is presented by the writers mentioned above and by various others, glacial erosion seems to be the most competent cause for corry lakes.

#### THE 14000 MALDIVE ISLANDS.

THE rarely visited Maldive archipelago is described in an interesting article by Rosset (Mitth. Geogr. Gesell. Vienna, XXXIX., 1896, 597-637). The islands are all of coral formation, seldom more than two meters above sea level, with much unhealthy swampy surface. They are seldom more than a few miles in diameter. More than a hundred islets may form the circumference of a single atoll, and sometimes the individual islets themselves have a ring-like, atoll form. The seaward submarine slopes are steep; the shores are attacked by heavy surf, and the natives believe that the land area is decreasing. The islands are separated by deep passages through which strong currents run one way or the other according to the monsoon season. Many channels breach the reefs and give access to quiet anchorages in the lagoons. The colors about an atoll vary from the purple waters off shore to the green, shallow water, the white coral strand, the olive

brown reef with dark green vegetation, and the bright green lagoon. A description of the people and their history follows.

W. M. DAVIS.

HARVARD UNIVERSITY.

#### CURRENT NOTES ON ANTHROPOLOGY.

##### ELEMENTS OF MELANESIAN ART.

AN article of prime value to students of early art and to anthropologists in general is that by Dr. K. Th. Preuss, in the *Zeitschrift für Ethnologie*, 1897, Heft III. and IV., on the artistic designs of the natives of Kaiser Wilhelms Land, New Guinea. The material he had at his command was a collection of over five thousand specimens now in the Museum of Ethnography, Berlin. He considers it practically complete, presenting the world of their art in line and figure. His article is illustrated with 199 figures in the text, yielding ample means for studying the leading motives of these savage artists. The analysis of their favorite forms is traced out with masterly precision, and as one follows the author in his unraveling the strange and intricate figures he copies, no doubt is left of the success of his undertaking.

In some introductory pages he refers to the bearing of such studies on the question of transmission or independent origin, and on the tendency of primitive man to copy from nature and to conventionalize his copies. Several popular impressions are corrected and sounder methods of comparison explained.

##### THE EXTENSION OF THE ARAWACK STOCK.

THIS stock of South American languages has peculiar interest, as it is that which spread over the West Indian Archipelago and the Bahamas at some remote date; and if any of the native languages of our Gulf States had South American affinities, they should be looked for in the Arawack and not

in the Carib dialects, as the latter never approached nearer than the south of Cuba.

In the *Zeitschrift für Ethnologie* 1897, Heft II., Dr. Paul Ehrenreich contributes new materials to the tongues spoken on Purus river by the Paumari, Ipurina, Araua and Yamamadi tribes, showing that these are branches of this widespread stock. He remarks: "From the islands of the Antilles far south to the sources of the Paraguay and Madeira rivers, one can now follow an almost unbroken line of Arawack dialects, in which, in spite of the great distance of more than thirty degrees of latitude, it is easy to show a complete grammatical identity."

This is another example of the general fact that the extension of accurate research is rapidly diminishing the number of South American linguistic stocks.

#### THE ALLEGED SUMMERIAN LANGUAGE.

THE Summerians, so-called, inhabited southern Babylonia about 5,000 years B. C. Their northern branch are known as 'Ak-kads.' Some say that they spoke a tongue allied to the Semitic stock, while other authorities have maintained that the sufficiently abundant remains of this very ancient idiom show marked analogies to the Ural-Altaic tongues. The latest advocate of this opinion is Dr. K. A. Hermann, of Dorpat, who, at the tenth Russian Archaeological Congress, urged strongly that the Summerian had the same construction, vocal harmony and phonetics as the Finnish-Ugrian branch of the Ural-Altaic stock.

In his paper, as reported in the *Centralblatt für Anthropologie*, Dr. Hermann fails to note the objections urged by the eminent Ural-Altaic scholar, Dr. Hugo Winkler to the supposed similarities of Summerian to Ugro-Finnic tongues. These objections are so cogent that they must be held conclusive for the negative. The Summerian, if it was not Semitic, which is still possible, may

have been Dravidian, or even a very primitive Aryan idiom. Either of these is more likely than the Ural-Altaic hypothesis.

D. G. BRINTON.

UNIVERSITY OF PENNSYLVANIA.

#### SCIENTIFIC NOTES AND NEWS.

##### THE WINTER MEETINGS OF THE SCIENTIFIC SOCIETIES.

THE societies meeting at Ithaca as we go to press represent perhaps the most important attempt to bring the sciences into fruitful relations now existing in America. The National Academy of Sciences and the American Association for the Advancement of Science are more important organizations. They have done more for science in the past, and it may be that they will do more in the future. The National Academy, however, at the present time does not exert a great influence. At a recent session there was only one person present in addition to about twenty members, and each of the papers presented was only of interest to two or three of the members. There was not a line regarding this session in the daily papers of the city in which the Academy met, and it was, perhaps, referred to nowhere except in this JOURNAL. The American Association has during the past ten years had at its annual meetings an average attendance of only about four hundred members with a tendency to decrease. These have by no means been exclusively the four hundred most competent men of science in America, and the total work of the Association has been disappointing. We may hope for much from the anniversary meeting at Boston next year, but it must be acknowledged that at present the Association is in a position to need help from scientific men rather than to give help to them.

The associations devoted to a single science meeting during the Christmas holidays—the Mathematical Society, the Geological Society, the Chemical Society and the affiliated societies concerned with the biological sciences convening at Ithaca—are doing their work with thoroughness and with fruitful results. We miss a physical society, but otherwise each of the leading sciences is represented by a well or-

ganized association which is contributing its share to scientific advance. The Society of Naturalists and the affiliated associations are, perhaps, of especial interest because they represent an attempt to keep a group of sciences in mutually helpful relations. Each society has its own organization and special work, but men of science in different but related departments are brought into personal contact, so that each may learn to appreciate the work of the others. The programs of the different societies promise that the meetings this winter will be of special interest, and we are sure that this promise will be confirmed by the reports to be published in this JOURNAL.

#### THE ECLIPSE EXPEDITIONS FROM GREAT BRITAIN.

ACCORDING to the London *Times* a considerable rearrangement has been made of the stations proposed to be occupied by the various British parties setting out to observe the total eclipse of the sun on January 22d. Sir Norman Lockyer will, as before arranged, occupy the most westerly of these stations—at Viziadrug, on the coast of India. The next station towards the east is where the Southern Mahratta Railway crosses the central line of totality near the station of Karad. Here Professor Michie Smith, the government astronomer at Madras, with his party, will take up his position. The Great Indian Peninsular Railway crosses the central line about 100 miles farther east at Jeur. Here Professor K. D. Naegamvala, the curator of the observatory of the Royal College of Science, Poona, with a large party of resident observers, will be encamped. A wide interval separates this station from the next, which will be occupied by a party sent out by the British Astronomical Association. This will consist of Mr. John Evershed, Mr. and Mrs. E. W. Maunder, Captain P. B. Molesworth, R.E., and Mr. C. Thwaites. This party is travelling out by the P. and O. steamer Ballaarat. Their camp will in all likelihood be pitched at Talni, on the line between Amraoti and Nagpur. Near them will be the second of the official parties sent out by the joint committee of the Royal Society and the Royal Astronomical Society, Sir N. Lockyer's party forming the

first, and consisting of Captains Hills, R.E., and Mr. Newall. Mr. Newall has already started, and Captain Hills will travel by the P. and O. steamer *Oriental*. Another 120 miles along the shadow track the third official station will be occupied by Dr. Copeland, Astronomer Royal for Scotland, on the high road between Nagpur and Seoni; whilst the fourth party, consisting of the Astronomer Royal (Mr. W. H. M. Christie) and Professor H. H. Turner, of Oxford, who also travel by the *Ballaarat*, is expected to be located at Sohagpur, on the line from Jubbulpore to Bilaspore, some 150 miles from Dr. Copeland. Finally, the second party of the British Astronomical Association, which will be under the leadership of the Rev. J. M. Bacon and will go out by the *Egypt*, is expected to take up its quarters for the eventful day at Buxar, on the Ganges, some 220 miles farther on. With the favorable meteorological conditions which prevail in India in January and this wide distribution of observing forces, it is to be hoped that no such severe disappointment as was felt in Norway and Japan during the eclipse of last year will be experienced on this occasion.

#### GENERAL.

As we go to press we receive intelligence of the important discovery announced by Professor J. C. Kapteyn, of Gronigen, that the *Star Cordoba Zone Catalogue* 5<sup>a</sup>. 243 has a proper motion of 8''7 on arc of a great circle. The largest proper motion hitherto known is that of 1830 Groombridge — 7''0 on arc of a great circle.

At the session of the *Academie des Sciences* held at Paris, December 13, 1897, the Cuvier prize of 1,500 francs was awarded to Professor O. C. Marsh, of Yale University. This prize 'is awarded every three years for the most remarkable work either on the Animal Kingdom or on Geology.'

The post of Government Botanist of Victoria, vacant by the death of Baron von Mueller, has been filled by the appointment of his former assistant, Mr. J. G. Luehman.

A CABLEGRAM reports that the will of Dr. Thomas W. Evans, the opening of which has been awaited with much interest, leaves nearly



his entire estate, estimated at \$8,000,000, for the Thomas W. Evans Museum and Institute of Philadelphia. Further details are lacking.

DR. T. PORTER, whose herbarium was reported to have been destroyed by the recent fire in Pardee Hall, Lafayette College, has made the following statement: "The Pennsylvania flora is saved entire and complete. It is the best in existence, and I am greatly relieved. I have labored a-lifetime on it. The collection of North America is saved to the extent of a little more than two-thirds; much that appeared utterly destroyed Saturday proves not to be so badly damaged as to be valueless. The offers of my friends in all directions which are coming in on me like a blessed shower will enable me to restore the collection. I am deeply touched by their generous sympathy and aid."

THE Harvard Natural History Society celebrated on December 17th its sixth anniversary. Professor Shaler gave an address on the history of the Society, and William T. Hornaday, of the New York Zoological Society, lectured on the preservation of our native birds. The Society now numbers over seventy members and has recently been organized into sections for the various branches of natural history.

THE sixty-sixth annual meeting of the British Medical Association will be held in Edinburgh from Tuesday, July 26, to Saturday, July 30, 1898. Since the Association met in Edinburgh twenty-three years ago many changes have taken place in the medical institutions of the city, and the Association will next year be able to meet in McEwan Hall, the magnificent new building of the University of Edinburgh.

THE deaths are reported of Dr. Friedr. Wilhelm Snyder, the botanist, at Braunsberg, at the age of 87 years; of Professor Raphael v. Erlanger, the zoologist, at Heidelberg, aged 33 years; of Dr. Wilhelm Joest, the explorer, in Australia; of Mr. Samuel A. Miller, of Cincinnati, the author of numerous contributions to zoology and paleontology, on December 19th, aged 61 years; of Dr. F. C. Schneider, emeritus professor of chemistry in the University of Vienna, aged 84 years, and of Dr. Schrauf, professor of mineralogy in the University of Vienna, aged 60 years.

WE are requested by Professor I. P. Roberts, Director of the College of Agriculture of Cornell University, to call attention to the university extension work in agriculture, provided last year by the Nixon Bill and placed under the direction of the College of Agriculture. The object of the work is the promotion of agricultural knowledge in the State. A reading course class has been organized for the study of some of the fundamental principles which underlie agriculture, and this study may be taken up at the farmers' homes. Those wishing to join the class, now numbering several hundred, will receive, free of cost, printed matter for study which will be followed by questions intended to lead to a discussion of any points not well understood by the pupil.

THE Société des Laboratoires Bourbouze, of Paris, offers scientific courses to workingmen, free of charge, on Sunday from nine to eleven o'clock. Physics and chemistry will be taught in the laboratories, the courses being adjusted to the practical needs of the students.

DECEMBER 5th was the sixth anniversary of Museum Sunday, instituted in Great Britain by the Sunday Society in 1892. About one hundred institutions were opened on that Sunday. The attendance at the British Museum was 458, and at the Natural History Museum 554. These numbers are scarcely as large as might have been expected.

THE United States Civil Service Commission announces that the examination which was scheduled to be held at Washington and elsewhere on January 8th, for the position of Computer in the Nautical Almanac Office, has been postponed to January 10th and 11th, it being found that it will be necessary to give two days for the examination. Very few applications have as yet been received for examination for this position. All persons desiring to compete should write to the Commission at once for application blanks and information.

PROFESSOR GABRIEL LIPPMANN, who was recently awarded the 'Progress' Medal of the Royal Photographic Society for 'Photography in colors by the interference method,' read a



paper on the subject before the Society on the 14th of December.

WE announced recently that the American Forestry Association would hereafter publish a journal devoted to the interests it represents. *Garden and Forest* states that the Association will take *The Forester*, founded and for the past three years edited by Mr. John Gifford, Princeton, N. J. The new office of *The Forester* will be at No. 73 Cochran Building, Washington.

THE Report of the Director of the Field Columbian Museum for 1896-7 reflects much credit upon the Museum staff, showing that a large amount of work has been accomplished by a small force and that good progress has been made in caring for the study series as well as in installing the exhibits. The report contains a number of plates showing the methods of installation in the various departments. The 'monographic installation of North American forest trees' seems extremely good, both from an educational and scientific standpoint. It comprises a branch, flowers, fruits and block of wood from one tree; a photograph of the same tree in summer and winter; a seven-foot section of the trunk, a transverse section; commercial planks and, finally, a map of North America colored to show the distribution of the species. The mammal groups of Mr. Akeley, who is unrivaled in this work, are deserving of special notice, particularly that of the Lesser Koodoo with its striking central figure. The group of Musk oxen contains, so far as we are aware, by far the best series contained in any museum.

*Appleton's Popular Science Monthly* for January contains an article on the 'Causes and Distribution of Infectious Diseases,' by Surgeon-General George M. Sternberg. The subject is treated historically, and includes a brief outline of the more serious epidemics of the past one hundred years.

WE quote the following editorial note from the December issue of the *London Educational Times*: "Eulogistic notices of the late J. J. Sylvester, Savilian professor at Oxford, whom our readers will remember as a frequent con-

tributor to our columns, have appeared in the mathematical and other journals of America, France, Germany and Belgium. Professor Halsted, writing in *SCIENCE* (U. S. A.), says: 'When one thinks that Sylvester, William Thomson, Maxwell, Clifford, J. J. Thomson, have all been second wranglers, one asks involuntarily if any senior wranglers, Cayley excepted, have been put on the same parallel with them?' Professor Halsted might have added Whewell and Glaisher to his seconds. But, as to the seniors, what about Paley (to match Whewell), Wollaston, the double seniors Kaye and Alderson, Herschel, Sir George Airy, Main, Stokes, Adams, Todhunter, Tait, Lord Rayleigh, and Cayley aforesaid? However, it must be admitted that there are some heavy weights in the other scale." There is nothing in any American college or university corresponding to the extreme specialization of the mathematical Tripos at Cambridge. Yet a method which secures such extraordinary results should at least be carefully studied.

To the numerous 'Années' recently established in France will now be added *L'Année sociologique*, edited by M. Durkheim, professor of sociology at Bordeaux, and published by M. Felix Alcan, Paris. The volume for 1897 will be issued early next year and will contain original articles by the editor and by Professor Simmel, of Berlin, followed by systematic reviews of the literature. We regret that the attempt will not be made to give a complete bibliography, but perhaps this will be added to later volumes.

THE *Western Medical and Surgical Gazette*, which has just begun publication at Denver, under the charge of professors in the Gross Medical College is, we believe, the two hundred and twenty-sixth monthly medical journal now being published in the United States. This would allow one monthly journal for each 500 physicians in the country, and probably not one-half of them subscribe for any journal. It is not necessary to predict whether mediocrity or progress through survival of the fit will result. It is, however, but fair to state that the new *Gazette* promises better than many of the medical journals that we receive.

PROFESSOR G. SERGI, of the University of

Rome, expounds in the January *Monist* his theory of the origin of Latin and Greek civilization, which he claims was not the creation of the Aryans, who were an inferior stock, but of the Mediterranean race proper; the Aryans merely transformed the *language* of the Mediterranean races. In the same number Major Powell traces 'The Evolution of Religion' in the light of ethnology and the general history of civilization; Dr. Woods Hutchinson holds an impassioned brief for 'Love as a Factor in Evolution,' wherein he shows that love, sympathy, charity, etc., which are generally supposed to be subversive of natural selection in society, are really the prime conditions of evolutionary progress, through their strengthening of the moral fibre and their enhancing of solidarity. The philosophical articles are: (1) 'Causation, Physical and Metaphysical,' by C. Lloyd Morgan; (2) 'The Philosophy of Laughing,' by Dr. Paul Carus; (3) 'On the Philosophical Basis of Christianity in Its Relation to Buddhism,' by Professor Rudolf Eucken. As for the first of these, Professor Morgan seeks the solution of the problem of causation in the separation of the domain of knowledge into two provinces, a physical province and a metaphysical province. The search for transcendental causation in the latter province is as legitimate in its way as the search for scientific causation in the former province. The book reviews of the number embrace philosophy, psychology, biology and comparative religion.

TEN or twelve years ago *The Critic* published a series of 'Authors at Home,' including sketches of Lowell, Whittier, Holmes and other American men of letters. In its issue for the 18th ult. *The Critic* begins a new series of 'Authors at Home,' with a sketch of 'Charles Conrad Abbott, M.D., at Trenton,' by Mr. Ernest Ingersoll, who holds that 'systematists and dissectors' have not appreciated Dr. Abbott's contribution to science, owing to 'its literary form.'

*The Contemporary Review*.—Why can we not have in America monthly reviews as good as *The Contemporary*, *The Fortnightly* and *The Nineteenth Century*?—for December contains several articles of scientific interest. A well-in-

formed writer who signs himself 'A British Naturalist' discusses the seal question from an American point of view. The article concludes with the paragraph: "Hence, considering that the industry is commercially of no great importance, that the pelagic sealing involves the killing of pregnant females and the starving of their pups, and that the United States can settle the question over the heads of England and Canada, it seems a pity that the argument should be embittered by abuse of the United States. The question has been so simplified that the officials on both sides no doubt see the advisability of a friendly settlement. And it is to be hoped that the British press will give that fair open-minded consideration to the American claims that has marked the irreproachable attitude of the British Foreign Office."

ANOTHER article in the current number of *The Contemporary Review* is a criticism, by Mr. Andrew Lang, of the recently published work on 'The Evolution of the Idea of God,' by Mr. Grant Allen. Mr. Lang maintains, and not without reason, that Mr. Allen's treatment is not strictly scientific in character, but Mr. Lang himself holds that savages got their idea of spirits from converse with real spirits. Whence the conclusion is not unnatural that literature, science and writing for the market do not combine to produce results of value to science.

AT a recent meeting of the Royal Botanical Society, of London, Mr. Sowerby, the Secretary, called attention, as reported in the *London Times*, to some kola plants grown in the gardens, and said that the tree, which was a native of the west coast of Africa between Sierra Leone and the Congo, belonged to the natural order Sterculiaceæ. The seeds, several of which were contained in a fleshy fruit, 4 inches to 6 inches long, were the well-known kola nuts of West Africa, where they had been used as far back as it was possible to trace. By eating these seeds people were enabled to endure prolonged labor and exertion without fatigue. It was estimated that kola paste is five times more sustaining than cocoa; it contained over 2 per cent. of pure caffeine, and, compared with tea, coffee and cocoa, the kola preparations were

far more nutritious and did not create biliousness, as did cocoa and coffee, nor nervous excitability, as in the case of tea, so that the problem of "What may we drink?" might probably be solved. A number of these plants were propagated at Kew in 1880 and distributed to Calcutta, Ceylon, Zanzibar, Demerara, Dominica, Sydney, Mauritius, Java, Singapore and Toronto, where the nuts were now produced. It had been reported from Jamaica that if a demand should arise for them the nuts could be shipped to the extent of many tons per year. Notwithstanding its important properties, it is only lately that any great demand has arisen for the production. As a medical agent it is specially valuable as a powerful nerve stimulant. The kola nuts may supply a valuable medicine to the pharmacopoeia, as Mr. Sowerby states, but it is doubtful whether the Kew Gardens have done a philanthropic work in extending its use. It is already sold in large quantities, both in Great Britain and America, and while it may itself be no more harmful than coffee, when mixed with from 10 to 25 per cent. of alcohol, as is usually the case, it becomes a powerful and dangerous intoxicant. The fact that it is sold at apothecaries, often to women and children, rather than in saloons does not decrease the harm that it does.

#### UNIVERSITY AND EDUCATIONAL NEWS.

IN amplification of the note published last week in this JOURNAL regarding the gifts of Mr. W. C. McDonald to McGill University, Montreal, we are informed that the endowment consists in the foundation of an additional chair of chemistry. It will be remembered that Mr. McDonald recently erected a new chemical building at a cost of \$240,000. Mr. McDonald has further now given an additional endowment of fifty thousand dollars for the Faculty of Law, to the Deanship of which Faculty, with the chair of Roman Law, Mr. E. P. Walton, of the Scotch bar, was recently appointed. Mr. McDonald has, moreover, supplemented the existing endowments associated with his name by a further gift of \$200,000, to provide for any deficiency in income that may result from the fall in the rate of interest on investments.

THE sum of \$45,000 has now been collected for a Science Hall for Syracuse University. It is expected that the erection of the building will be begun in the spring.

MRS. GEORGE SMELTZ, of Hampton, Va., has given \$5,000 to Richmond College, to be used in the erection of a science building.

A NEW building for the biological laboratory was begun at Adelbert College in October, and will probably be completed in September, 1898. The building is of Gothic design and is to be built of stone, three stories high and basement. The outside dimensions are about 93 by 63 feet. The estimated cost with equipment is \$43,000.

WITH the October Convocation the University of Chicago closed its first period of five years of graduate work, during which it conferred the degree of Doctor of Philosophy on seventy-seven candidates, distributed among the several departments as follows: Zoology, 12; Chemistry, 6; History, 6; English, 6; Sociology, 5; Semitic, 5; Political Economy, 4; Germanic, 4; Greek, 3; Romance, 3; Geology, 3; Physiology, 3; Mathematics, 2; Indo-European Comparative Philology, 2; Physics, 2; Anthropology, 2; Philosophy, 1; Botany, 1; Biblical and Patristic Greek, 1; Political Science, 1; Paleontology, 1; Comparative Religion, 1; Old Testament Literature, 1; Systematic Theology, 1; Church History, 1; not represented, Anatomy, Archaeology, Astronomy, Latin and Neurology. The student of science may fairly ask whether, when twelve doctorates are conferred in zoology and but three in Latin and Greek combined, this means that there is less demand for teachers of the classics or that a less exacting preparation is required.

WE quoted in a recent issue the statement of the principal of the 'late' Evelyn College to the effect that the College had been closed because Princeton University refused to recognize its work for the higher education of women. A correspondent fully acquainted with the facts writes us: "Evelyn College was closed on account of bad debts, and in the opinion of its own board of trustees should have been closed some time ago. So far from giving the institution the cold shoulder the University authorities allowed

their names and the University name to be freely used. Various professors expended much time and effort on their courses in Evelyn, and continued to do so, though generally failing to receive the small stipend which was promised them. Certain University officers, both faculty and trustees, served on the Evelyn board, but resigned because they could not approve of the way the institution was financially managed. Seeing that Evelyn College was closed only after the patience of everybody in Princeton, from tradesmen to trustees, was tried to the utmost, and the courtesies of the authorities strained to the breaking point, it is necessary that such a misstatement of the facts should be corrected." These facts do not apparently relieve Princeton University from the responsibility of being the only considerable university in the world that does not provide in any way for the higher education of women.

#### DISCUSSION AND CORRESPONDENCE.

##### BEHRING SEA CONFERENCES.

TO THE EDITOR OF SCIENCE: I have read with great interest the article on the results of the Behring Sea conferences, published in your number of November 26th (SCIENCE, N. S., Vol. VI., p. 781), which puts forward what is, I believe, the view of the 'seal question' held by most naturalists in every country in a clear and temperate manner. I venture to point out to you that more than four years ago I endeavored to place the question in a somewhat similar light before the British public in an article entitled 'A Naturalist's View of the Fur-Seal Question,' published in *The Nineteenth Century* for June, 1893, Vol. XXXIII., p. 1038). I beg leave to add an extract from this article in order to show the conclusions to which I had then arrived: "The absolute prohibition of 'pelagic' sealing which is demanded by the Americans, and which out to be carried out in order to ensure the continued existence of the fur-seals, can only be obtained by mutual arrangement among the parties interested. The fur-seal of Alaska (practically now the only remaining members of the group of fur-seals) should be declared to be, to all intents and purposes, a domestic animal, and its capture abso-

lutely prohibited except in its home on the Pribilof Islands. Looking to the great value of the privilege thus obtained, America might well consent to pay to Great Britain and her colonists some compensation for the loss of the right of 'pelagic' sealing; the amount of this compensation would be fairly based upon the number of fur-seals annually killed upon the Pribilof Islands. The 'royalty' thus levied would no doubt increase the price of seal-skin jackets. But seal-skin jackets are not a necessary luxury, and an additional pound added to their cost would not be of material consequence to the ladies who wear them. As a naturalist, therefore, I think that the fur-seal should be considered in the light of a domestic animal, and that all 'pelagic' sealing should be stopped, while the owners of the sealeries should at the same time pay to the other nations interested a reasonable compensation for the valuable privileges thus obtained."

P. L. SOLATER.

3, HANOVER SQUARE, LONDON, W.

December 15, 1897.

##### THE ENCHANTED MESA.

TO THE EDITOR OF SCIENCE: Referring to your postscript to my letter written in response to a communication to SCIENCE by Professor Libbey, I take the liberty of saying that, as the gentleman mentioned has *not* stated positively that *he* erected the stone monument on the summit of the Enchanted Mesa, one must reach such a conclusion only by inference. My reasons for not accepting anything short of a statement couched in unmistakable terms are based on what Professor Libbey has already contributed to the literature of the Enchanted Mesa. In the first place (*Princeton Press*, July 31) he says:

"No traces of former inhabitants were found. Further, no altars or traces of prayer sticks were found. \* \* \* Not the slightest trace was found which would enable me to believe that a human foot had *ever before passed* over the top of this famous rock."

Again (*Princeton Press*, August 21) he says:

"For two hours I walked over the surface of the rock. \* \* \* It is a splendid site for a pueblo, if some means of access could be de-



vised, but it could not have been freer of all traces of former occupation if it had been thoroughly swept up the day before. Only once was it that a doubt crossed my mind, when I came across a cairnlike monument which looked as though it might have been constructed by human hands. But the possibility of its being the result of erosion is also quite as strong as the other. No bits of pottery, no broken household utensils of any sort, no traces of construction of any sort were visible, not even the deepening of the natural surface of any of the rock cavities for the purpose of rain-water storage for drinking use, betrayed even the slightest indication that the top of the Mesa had ever been the prehistoric home of the Acomas."

In *Harper's Weekly* (August 28) Professor Libbey makes the following statement:

"There were no remnants of pottery, or fragments of household utensils, or implements of any kind; no water-tanks for the storage of rain water; one object alone looked as though it might have been built by human hands, and that was a small cairnlike mass of stones."

In this article Professor Libbey pictures the operation of his gun, boatswain's chair, etc.; but where is the 'cairnlike mass of stones' which he found, the origin of which he seems to be at such a loss to determine? It seems to me that this doubtful feature is the most important of all the observations made by Professor Libbey during his brief stay on the summit, and yet he left it unphotographed.

Later, in the *Philadelphia Press* (October 10), Professor Libbey says:

"The cairn-like pile of rocks, which I am glad Mr. Hodge so clearly decides is a cairn, is possibly the best proof of a mere visit, for even primitive people are not given to building cairns in their back yards. \* \* \* \*

"I am inclined from the facts which I was able to observe upon the top of the Mesa *still* (!) to believe that while the top may have been visited, no evidence exists at present of its ever having been permanently inhabited.

"I picked up some fragments which resembled ancient pottery, but could not persuade myself that they were. I took them to Mr. Pearce [one of the reporters who accompanied

Professor Libbey], and he agreed with me that they were not pottery."

The fact that the Professor fails to speak of having occupied part of his precious two hours in the erection of the lichen-covered rock-pile which we found and photographed, and the fact also that the structure occurs on a spot so protected from the surface wash that it may have stood there for ages, were sufficient to mislead anyone, and my error may be regarded as acknowledged when Professor Libbey states openly that the monument was erected by himself.

The better part of two days of research by the members of my party, each of whom had his eyes open, failed to reveal any other artificial monument than the one which I have figured. I am, therefore, safe in concluding that there is no ground whatever for the belief that any other artificial cairn or cairn-like structure exists on the summit of the Enchanted Mesa. If Professor Libbey constructed the cairn referred to, then he might have spent the portion of the two hours consumed by its erection in a way more profitable to archæology. Whether or not it was erected by him, the evidence of the former occupancy of the summit of the Enchanted Mesa is not weakened in the slightest degree.

F. W. HODGE.

BUREAU OF AMERICAN ETHNOLOGY,

WASHINGTON, December 14, 1897.

#### LAMARCK AND THE 'PERFECTING TENDENCY.'

In preparing some lectures on the history of evolution theories I have come across a curious difference of opinion among distinguished writers. Professor Osborn ('From the Greeks to Darwin,' p. 163) seems to contradict himself in the same paragraph. He says: "Lamarck believes that we see in nature a certain natural order imposed by its Author, which is manifested in the successive development of life; we thus study natural forces and nature abandoned to its laws. In this sense we see nature creating and developing without cessation towards higher and higher types. External conditions do not alter this order of development, but give it infinite variety by directing the scale of being into an infinite number of branches."

This statement might, without violence, be paraphrased by saying: "Lamarck believed in a tendency toward perfection, modified by external conditions;" which I believe to be strictly correct. But Professor Osborn's next sentence is: "Lamarck denied, absolutely, the existence of any 'perfecting tendency' in nature, and regarded evolution as the final necessary effect of surrounding conditions on life."

On looking up other writers I found that a belief in a perfecting tendency is ascribed to Lamarck by Lyell (*Principles*, Vol. II., p. 259), Darwin (*Origin*, Amer. ed., I., pp. xv+153, and *Life*, I., p. 384), Spencer (*Biology*, Section 146), Romanes (*Darwin and after Darwin*, I., p. 255). Perrier (*Phil. Zool.* avant Darwin, p. 84) argues strongly on the same side. Strangely enough, Quatrefages (*Darwin et ses Précurseurs Français*, p. 65) takes quite the opposite view, and directly accuses Darwin of error. I have been unable to consult any of Lamarck's works except the *Philosophie Zoologique*, but so far as that is concerned the majority view seems to be the correct one. Throughout, though Lamarck does not exactly use the expression 'perfecting tendency,' he distinguishes between two things—one, the *échelle*, the *dégradation* or *gradation* of organisms, their tendency to *composition* (complication, advancement); the other, the influence of environment in altering their needs and thus their structure. The *échelle* is a pre-established order through which organisms have progressively evolved, but visible only in its grand outlines, because changing conditions have indirectly altered the form of the organisms, especially externally, and thus obscured the details.

A pre-established order of evolution from the lowest to the highest forms seems to amount to the same thing as a tendency towards perfection.

I have been unable to find any passages which can be construed as an absolute denial of a perfecting tendency, but I have found a good many which indicate that Lamarck believed in it; whether or not because he was unable to suggest anything better to account for the progressive evolution which he saw, who can say? The following are sufficiently good examples:

"La puissance absolue du sublime Auteur de toutes choses, n'a-t-elle pu créer un *ordre de choses* qui donnât successivement l'existence à tout ce que nous voyons comme à tout ce qui existe et que nous ne connaissons pas?" (*Phil. Zool.* ed. 1873, I. p. 74.)

"Je vais faire voir que la nature en donnant, à l'aide de beaucoup de temps, l'existence à tous les animaux et à tous les végétaux, a réellement formé dans chacun de ces règnes une véritable échelle, relativement à la composition croissante de l'organisation de ces êtres vivants, mais que cette échelle, qu'il s'agit de reconnaître, en rapprochant les objets, d'après leurs rapports naturels, n'offre des degrés saisissables que dans les masses principales de la série générale, et non dans les espèces ni même dans les genres: la raison de cette particularité vient de ce que l'extrême diversité des circonstances dans lesquelles se trouvent les différentes races d'animaux et de végétaux n'est point en rapport avec la composition croissante de l'organisation parmi eux, ce que je ferai voir, et qu'elle fait naître dans les formes et les caractères extérieurs des anomalies ou des espèces d'écarts que la composition croissante de l'organisation n'aurait pu seule occasionner." (I. c., p. 121.)

On page 144 Lamarck says: "Il est évident que si la nature n'eût donné l'existence qu'à des animaux aquatiques, et que ces animaux eussent tous et toujours vécu dans le même climat, la même sorte d'eau, la même profondeur, etc., sans doute alors on eût trouvé dans l'organisation de ces animaux une gradation régulière et même nuancée." And then he shows that differences in the composition, depth, etc., of the water have brought about disturbances in the regularity of the gradation. Lamarck invariably uses *gradation* in the sense of an upward series, opposing it to *dégradation*, a downward series.

A very important passage is that quoted by Perrier from *Phil. Zool.*, p. 114. Lamarck states the struggle for existence according to his imperfect conception of it, showing how big and little animals alike are kept within due bounds. He concludes: "Ainsi par ces sages précautions tout se conserve dans l'ordre établi; les changements et les renouvellements perpétuels qui

s'observent dans cet ordre sont maintenus dans des bornes qu'ils ne sauraient dépasser; les races des corps vivants subsistent toutes, malgré leurs variations; les progrès acquis dans le *perfectionnement* de l'organisation ne se perdent point; tout ce qui paraît désordre, renversement, anomalie, rentre sans cesse dans l'ordre général et même y concourt; et partout et toujours la volonté du sublime Auteur de la nature et de tout ce qui existe est invariablement exécutée." Lamarck rather rarely uses the word *perfectionnement*; hence I have italicized it.

The passage concerning the aquatic animals very clearly shows a belief in a tendency toward perfection apart from other factors. The other passages, especially the last, are fully confirmatory.

I have been unable to consult the *Histoire Naturelle*, except as quoted by Professor Osborn and others. Possibly it is there that Professor Osborn finds authority for the statement that Lamarck denied absolutely the existence of a perfecting tendency. But so far as the *Philosophie Zoologique* is concerned the case is clear.

The point I have raised is important now only as a matter of history, but in the interest of accuracy it seems desirable that Lamarck's true views should be emphasized. It would appear that he was not 'completely carried away with the belief that his theory of the transmission of acquired characters was adequate to explain all the phenomena' (Osborn l. c., p. 180); rather, the 'Lamarckian factor' played a subordinate part in his scheme of evolution. And, if this interpretation be correct, it would seem that Darwin's criticisms of Lamarck are more nearly just than is generally supposed, and that, as Perrier says, he was, 'by an astonishing contradiction, at once a finalist in his general views, and a determined opponent of final causes in details.'

JOHN GARDINER.

UNIVERSITY OF COLORADO, BOULDER, COLO.

#### MEMORIAL MEETING COMMEMORATIVE OF ALLEN AND HORN.

A GENERAL invitation is extended to all those interested to be present at a memorial meeting, commemorative of Harrison Allen, M.D., and

George H. Horn, M.D., to be held in the library hall of the Academy of Natural Sciences of Philadelphia, on Friday evening, December 31st, at eight o'clock. The following gentlemen will make addresses:

Dr. Edw. J. Nolan, 'The Relations of Doctors Allen and Horn to the Academy and other Societies.'

Mr. S. N. Rhoads, 'Dr. Allen's Work in Zoology.'

Dr. D. G. Brinton, 'Dr. Allen's Contributions to Anthropology.'

Professor John B. Smith, Sc.D., 'Dr. Horn's Contributions to Coleopterology.'

Rev. Henry C. McCook, D.D., 'Dr. Horn as a Physician and Naturalist.'

E. G. CONKLIN, Ph.D.,

J. CHESTON MORRIS, M.D.,

D. G. BRINTON, M.D.,

REV. HENRY C. MCCOOK, D.D.,

HENRY SKINNER, M.D., *Ch'm.*

Committee.

THE ACADEMY OF NATURAL SCIENCES  
OF PHILADELPHIA,  
LOGAN SQUARE.

#### SCIENTIFIC LITERATURE.

*Memorials of William Cranch Bond, Director of the Harvard College Observatory 1840-1859, and of his son, George Phillips Bond, Director of the Harvard College Observatory 1859-1865.* EDWARD S. HOLDEN. San Francisco. 1897. Pp. iii+296. Soc. With illustrations.

In this work Professor Holden has given a most interesting account of the two men who established the Observatory of Harvard College and carried it on for its first quarter of a century—a time of great importance for the development of astronomy in this country.

In 1840 the beginnings of permanent observatories in this country had already been made; in 1865 the Observatory at Cambridge had acquired, under the Bonds, a recognized position in the astronomical world, and the Bonds had contributed to the general progress of the science.

Professor Holden's work has been rendered important, and at the same time difficult and thankless, by circumstances which he finds

himself compelled to mention. It cannot be called a history of American astronomy for the quarter of a century in question, but Professor Holden has furnished, with the help of the family of the Bonds, a valuable contribution thereto.

The most troublesome part of the author's task has been to rightly explain the long and persistent unfriendliness of prominent American astronomers to the new institution and its conductors. W. C. Bond was one of those quiet artists who so often do admirable service to the science in an unpretending way without making claim to the position of a great theoretical astronomer.

The first difficult task for Professor Holden has been to give the history of chronographic registration and the part of the Bonds in the invention.

Wilkes in 1844 (p. 239) made the first experiment for determining longitude by the electric telegraph between Washington and Baltimore. Sears C. Walker, a most able astronomer, gives in *Silliman's Journal*, Second Series, Vol. VII, pages 206 to 217, a report to Dr. A. D. Bache, then Superintendent of the Coast Survey, in which the history of the first experiments in chronographic registration is well told. Professor Holden mentions the subsequent experiments of 1847 and 1848 to render the telegraphic method thoroughly practicable for longitude determinations.

In Loomis's 'Recent Progress of Astronomy' (New York, 1850) we find the actual results of the longitude operations of the summer of 1847 conducted between Philadelphia, Washington and Jersey City, from which Loomis draws the inference: "These experiments seem to authorize the conclusion that the electric telegraph affords the best means for the determination of terrestrial longitude between places in telegraphic connection with each other." This inference of Loomis has been confirmed by subsequent experience.

Walker, in his article before cited, mentions the experiments of Locke, Mitchell and others, and dwells greatly on the merit of the proposed 'automatic clock register,' and of the principle of chronographic registration for all time-observations.

Locke's part in the experiment seems to have been to arrange, under Walker's direction, apparatus for making and breaking circuit without damage to the clock. Mitchel, on the other hand, suggested a form of chronograph not suitable in Walker's opinion for nice astronomical observations.

The apparatuses of both Locke and Mitchel were tried in 1848 under Walker's direction. On the whole, Professor Holden has well stated the history; some points are obscure in all the accounts, and it requires a careful reading and putting together of the literature of the subject to rightly assign priority in the different parts of the invention, in which howsoever we combine the materials; the principal figures are Walker and W. C. Bond, and the subordinate ones are Locke and Mitchel.

Bond's chronograph was exhibited at the Great Exposition of 1851 in London, and distinguished with a gold medal. These circumstances seem to have led to the introduction of chronographic registration at Greenwich in 1854. Thence it spread rather slowly over the Continent; it was adopted for standard right ascension at Pulkova in 1861, but the eye and ear method was still retained there for polar stars and secondary catalogues, in which it has some advantages, especially in respect of personal equations. In America the chronographic method has been used quite generally, and the Bond chronograph has become a standard instrument. It has been used at the Harvard College Observatory from its first construction in 1850 to the present time. It served for the zone 50°-55° of the catalogue of the *Astronomische Gesellschaft*, as well as for the Bonds' own zones of small stars observed in 1852-53, and other work executed during their successive directorships and later.

Other difficult matters of the history of the Observatory are stated by Professor Holden with due regard for the feelings of the representatives of the astronomers of the last generation. The Perkins professor of astronomy when W. C. Bond removed to Cambridge in 1838 and began the duties of his office was Benjamin Peirce, one of the most eminent mathematical astronomers of his day. It is rather difficult, as Professor Holden im-



plies on pages 36 and 37, to understand the whole matter, without alluding to 'grievances half a century old.' W. C. Bond became, in 1838, 'astronomical observer' without salary except the rent of a dwelling house, and without definite relations to the younger 'Perkins professor.' Peirce, perhaps, expected rather too early from the new establishment results which could be 'passed over to the computer.' G. P. Bond, B. A. (Harvard), 1845, was a diligent student of astronomy in all its branches, and soon showed himself capable of improving the methods of computation, as is shown by his early papers, especially 'Some Applications of the Method of Mechanical Quadratures'—a paper which anticipated an important method of Encke's, and which affords ideas not yet completely worked out. One of the few papers which he contributed to the *Astronomical Journal* is entitled 'On the Orbit of Wilmot's Comet,' and employs methods of his own which deserve study.

When W. C. Bond passed away in 1859, at the age of 70, his son had long been the chief assistant in the Observatory, and succeeded quite naturally to his father's place, but Peirce had been himself a candidate, and circumstances had brought about an estrangement between him and Bond, but the latter seems to have done his best to renew pleasant relations.

Other matters, easily traced, are involved in the reasons why these relations were not renewed. Professor Holden alludes to the circumstance that George Bond was not selected as an original member of the National Academy of Sciences as a matter requiring explanation. But this concerns the history of American science in general, and not merely the few persons who may have made up the list submitted to Congress. It is not best to imply here that the omission was more unfair than similar transactions are often liable to be.

At the time, 1863, when the National Academy was founded, Bond had been four years Director of Harvard College Observatory, and had shown in that capacity ample knowledge of mathematics and astronomy to fill the position completely. He had gathered around him a corps of hard working assistants, among them Asaph Hall. The meagre

salaries which the College could pay were rendered still more inadequate by the war then prevailing, and the corps of astronomers was diminished by the call for soldiers. One able and enthusiastic observer, Sidney Coolidge, fell in the battle of Chickamauga. The remainder of the assistants were compelled, with one exception, to seek occupation elsewhere. Bond himself struggled on heroically, although stricken with a mortal disease, and finally passed away at his post in 1865, before the close of the war, after completing the great work on Donati's Comet of 1858, the first work of an American astronomer to be rewarded with the gold medal of the Royal Astronomical Society. The vindication of the wisdom of his appointment as Director was complete, but he never received the medal which reached America a short time after his death.

Professor Holden's book has been put together from G. P. Bond's diaries and correspondence, and with the zealous cooperation of his family, Mrs. Richard Bond and his daughters. The author's work is, on the whole, well and judiciously done; some trifling defects are apparently due to unfavorable circumstances; such, for instance, are the want of a subject index; the Index of Proper Names is very defective; the spelling of German names like Brünnow and Rümker is not correct, and the use of capitals to indicate names of persons is a technical practice not approved in general literature. While the book is not a complete history of astronomy in America from 1840 to 1865, it affords precious materials for such a history, and should be read by all who desire to follow out that period of our science, and at the same time to become acquainted with two of its most prominent and faithful workers in the traditional as well as in the newer astronomy. G. P. Bond's experiments in astronomical photography were of very great importance and, in fact, were prior even to Rutherford's.

TRUMAN HENRY SAFFORD.

WILLIAMS COLLEGE.

*Handbuch der Klimatologie.* Von DR. JULIUS HANN. Stuttgart, Germany, J. Engelhorn. 1897. Second edition. 3 vols. 36 Marks.

If I were asked to mention the greatest authority on matters pertaining to climate and

climatology I should give, without hesitancy, the name of Dr. Julius Hann, the director of the Austrian meteorological service.

In 1883 Dr. Hann published a long needed book, a general treatise on the climatology of the whole earth's surface. This work was the outcome of many years of special study and research, and required several years of direct labor in its actual writing. It was received with enthusiasm by the German reading scientific public, and English readers deplored the fact that we had no corresponding work in English. Fourteen years have now elapsed since Hann's work first appeared, and its second and greatly enlarged and rewritten edition finds our language still without any general work on climatology. We have not even a translation to fill the place which should be occupied by a work of honest English or American authorship, and it is to be hoped that some publisher will be induced to take advantage of the appearance of this new German work by bringing out a translation of it either in full or in abridgment.

Hann's climatology consists of three volumes. The first is devoted to general climatological conditions, in which the relations of cause and effect are discussed for the various meteorological elements. The second volume is devoted to the special climatology of the regions embraced in the tropical zone. The third volume treats of the climate of the temperate and cold zones.

One serious drawback to the usefulness of the work is the lack of climatological charts; but the author explains that they were omitted because they would considerably increase the price that must be asked of purchasers of the present treatise, and, moreover, such charts had been published elsewhere in easily accessible form.

The 404 pages of Vol. I. contain: A general idea of the scope of climatology; and complete explanations of the nature, importance and relation to each other of the climatic factors, temperature, humidity, precipitation, cloudiness, wind, air pressure and evaporation. A short statement of the composition of the air and the impurities which it may contain, together with some remarks on plant phenology

as related to, and dependent on, climatic conditions. A brief though comprehensive review of our knowledge of the amount of radiation from the sun and the resulting 'solar climate.' The principal forms of telluric or physical climate, which is the solar climate modified by the earth's atmosphere and the existing distribution of land and water; this naturally occupies the greater portion of Vol. I. And, finally, the meteorological cycles and climatic oscillations.

Let us notice more particularly some of the most interesting facts given by the author.

Owing to the elliptic form of the earth's orbit, by which the earth is sometimes a little nearer the sun than at other times, the southern hemisphere receives more solar heat in summer and less in winter than the northern hemisphere. If our earth had no atmosphere the average temperature at the earth's surface would be, at the equator for the hottest month  $67^{\circ}\text{C}$ . and for the coldest month  $56^{\circ}\text{C}$ ., and at the poles for the hottest month  $82^{\circ}\text{C}$ . and for the coldest month  $-273^{\circ}\text{C}$ . (which latter is, curiously enough, the absolute zero of the thermometric scale).

Concerning the interesting question of the effects of forests on rainfall Hann says that from the nature of the case it is almost impossible to prove anything by direct measurements, and that the increase of rainfall due to forest growth has been far over-estimated. It is quite probable, however, that in the tropics the woods do slightly increase the amount of precipitation, and extensive woods in the middle and higher latitudes probably increase the frequency of rainfall.

The effects of mountains on rainfall has received thorough treatment at the hands of the author, and especially that peculiar phase of increase of rainfall with the altitude up to a certain level, and the subsequent gradual decrease at greater heights. With an increase of altitude amounting to from 2,000 to 4,000 feet the rainfall may be increased by from 50 to 250 per cent. This increase of rainfall is due to the condensation of the moisture in ascending air currents which form on mountain sides.

It has been computed, retrospectively, that in Jurassic times the mean temperature of the earth was about  $2^{\circ}\text{C}$ . warmer than it is at pres-

ent. At about Lat. 30° N. it was colder, but in other latitudes warmer, and at the equator about 6.5°C. warmer than now.

The decrease of air temperature with the increase of altitude above the sea-level is of very great importance in climatological considerations, and Hann has given a careful discussion of this phenomenon.

The average decrease of temperature in mountain regions is 0.57°C. per 100 meters ascent, and it seems to be quite uniform for both equatorial and arctic regions. For the very gradual ascents, such as long slopes, the temperature decrease is but about 0.40°C. per 100 meters ascent; while for the free air it is probably about 0.65°C. These values show considerable retardation of the dynamic change of temperature, which is about 1°C. per 100 meters ascent.

Among the peculiar winds none are more interesting than the hot, dry winds which occur in certain mountain regions, and which in Europe are known as Föhn winds, and in the United States as Chinook winds. It was to have been expected that Dr. Hann would devote considerable space to these winds, because they are with him a pet subject; although his modesty has caused him to place his first contribution to its literature a long way down in the reference list, whereas it should have headed that bibliography. Probably no single class of winds have been so little understood as these Föhn winds; and after searching in all directions for some reason for their existence, the simple theory that they are due to the dynamic heating of descending air masses which have a decreased relative humidity due to the increased temperature has sufficed to explain what was considered a most complex phenomenon.

One very interesting problem in climatology is, to determine how the different elements, such as temperature, rainfall and cloudiness, vary with changes of latitude. This is shown by finding the average values of the elements for certain parallels of latitude throughout their whole length as they encircle the globe.

The following little table gives for various latitudes the average temperature for the whole year in degrees Fahrenheit; the average total annual depth of precipitation (which includes

both rainfall and snowfall) in inches; and the average annual amount of cloudiness measured on a scale of 0 = a clear sky, and 100 = a sky entirely overcast with clouds.

Lat.	Temp.	Precip. inch.	Cloud per cent.
N. 80°	2°	14	—
70	14°	14	59
60	30°	19	61
50	42°	23	58
40	57°	21	49
30	68°	24	42
20	77°	32	40
N. 10	80°	76	50
Equator	79°	77	58
S. 10°	78°	67	57
20	74°	30	48
30	65°	26	46
40	54°	37	56
50	42°	46	66
S. 60°	31°	[40]	75

This table is also interesting from the fact that it indicates that we have meteorological observations 20° nearer the pole in the northern hemisphere than in the southern hemisphere.

The last section of this volume, which treats of climatic changes, may be divided into two parts—that treating of changes in geologic times, and that of changes shown by the records of modern civilization. This last has already been given to readers of meteorological literature in Brückner's *Klimaschwankungen*, and this same authority is freely quoted by Hann. But the outline of the various theories accounting for climatic changes in the distant past is a much needed summary. Hann states briefly the main theories which have been promulgated and which depend on possible changes in the inclination of the ecliptic, or in the eccentricity of the earth's orbit. A rough computation convinces him that the effects of neither of these would account for the changes which must have taken place in the earth's climate. Croll's theory is given due prominence, but Hann finds it unsatisfactory. A theory developed by Luigi de Marchi makes a variation in the coefficient of transmission of solar radiation through our atmosphere the important factor in these great climatic changes; but no certain causes of increase or decrease in the amounts of water vapor or carbonic acid gas, which would mainly affect the values of this coefficient, have been pointed out as appli-

cable to the existing case without any manner of doubt. The mystery of the great ice age, and of the former rich vegetation in the present cold zone, still remains to be solved.

FRANK WALDO.

*An Outline of the Theory of Solutions, and Its Results, for Chemists and Electricians.* By J. LIVINGSTON R. MORGAN, PH.D. (Leipzig), Instructor in Quantitative Analysis, Polytechnic Institute, Brooklyn. New York, John Wiley & Sons; London, Chapman & Hall. 1897. Pp. 63.

The contents of this work are four lectures, delivered before the Brooklyn Institute of Arts and Sciences, and deal with the theory of solutions, methods for the determination of electrolytic dissociation, the theory of the voltaic cell, and analytical chemistry from the standpoint of electrolytic dissociation.

The author states in his preface that "a knowledge of the theory of solution and its results, is so important to workers in all branches of chemistry and electricity, that the following pages have been compiled, containing an elementary treatment of the subject." \* \* \* "If by this sketch the author can induce any one to go deeper into the subject he will feel more than repaid for his work."

H. C. J.

*Untersuchungen über das Erfrieren der Pflanzen.*

MOLISCH. Jena, Gustav Fischer. 1897. Pp. viii + 73. 11 illustrations.

A notable addition to the physiology of the cell has been recently published by Professor Molisch as a result of several years' work upon the effect of cold upon plants.

The researches upon which generalizations rest are fragmentary and necessarily inaccurate, since they were carried on in the open air or under conditions of great discomfort to the observer. At the same time no regulation of the temperature could be effected. Dr. Molisch has been enabled to obtain results of great importance, both from the advance in cell physics since the time of Muller's experiments and by the use of ingeniously constructed apparatus.

Dr. Molisch's researches were chiefly conducted by means of a double-walled freezing chamber of wood 33 x 33 x 27 cm. outside meas-

urements. The space of 7 cm. between the double walls on five sides of the chamber was filled with sawdust. The center of the chamber was occupied by a zinc compartment to contain a microscope. A tubulated opening through the walls of the zinc and wooden compartments allowed access of light to the mirror, and toothed rods for adjustment of the stage, objectives and mirror extended outside the walls. The space surrounding the zinc compartment was filled with a mixture of salt and ice, by which temperatures of 4°C. to 10°C. were obtained in a room kept at 10°C.

As a useful preliminary, observations were made upon the freezing of colloidal substances, emulsions, color and salt solutions. The crystals were seen to appear suddenly in a colloid, such as gelatine, and to increase in size, extracting the water from the gelatine, so that the latter shrunk into a network resembling parenchyma tissue. Some colloids return to the original condition upon thawing; others do not. Starch paste is an example of the latter. The suspended particles in an emulsion, such as latex, aggregate in the form of a network of bands upon freezing. Freezing of color and salt solutions result in the more or less complete separation of the solid and solvent.

The chief interest of the paper lies in the results of the direct and continuous observation of the freezing of living cells.

An amoeba, after exposure of 25 minutes to a temperature of 9°C., exhibited the formation of clumps of ice crystals in the plasma, and finally became a solid lump consisting of a complicated network of plasma almost devoid of water, ice crystals, vacuoles of concentrated cell-sap and air-bubbles. The slender filaments of *Phycomyces* froze only when the temperature fell to -17°C. The small diameter of the cells seem to be a direct adaptation against freezing. Yeast cells exhibited a shrinkage of 10 per cent., due to loss of water when the medium was frozen, but the cells were not killed at -15°C. The freezing of *Spirogyra* filaments at -3 to -6°C. is accompanied by a shrinkage in diameter amounting to 62 per cent. and by the final aggregation of chlorophyll band and nucleus in the center of the cells. The excretion of water in this plant under low temperatures may be easily observed



if a specimen is mounted in olive oil. The excretion of water from the cells soon begins and a cylinder of ice is formed about the filament.

As a result of the work upon unicellular structures in many organisms, it is found that the freezing may be accompanied by the formation of ice in the cell, external to the cell membrane or in both places. In either case it is accompanied by a more or less complete separation of the water from the plasma. The exposure of tissues with strongly developed walls to low temperatures was accompanied by the excretion of ice into the intercellular spaces, followed by the formation of ice both here and in the cell. Not all the cells of a plant exhibit the same resistance to cold. A temperature of a few degrees below zero Centigrade may freeze a leaf while the guard cells and hairs will remain intact. These cells are likewise highly resistant to heat and other agencies, as Leitgeb has previously demonstrated.

The question as to the death of a plant upon freezing or consequent thawing has engaged the attention of a large number of workers. Molisch's results prove that generally the death of a plant is due to the direct action of cold upon the plasma, and that the consequent thawing does not matter whether slow or rapid, in air or water. To this generalization an exception is offered by the experience of Müller-Thurgau, who found that frozen fruits of the apple and pear were not destroyed if thawed slowly, a fact long known in household practice, and the experiment of Molisch with *Agave americana*, which behaved in a similar manner. These exceptions, of course, rest upon the provision that the temperature has not fallen below a certain limit.

The death of plants from temperatures above the freezing point may result from disturbances of the metabolic processes or the transpiratory activity. In the latter instance the 'frosting' of a plant is due to the decreased osmotic activity of the root hairs under low temperatures, and wilting of the leaves consequent upon an insufficient supply of water. Dr. Molisch is mistaken in attributing the origin of this idea to Krabbe, as the principle has been known for many years, although its detailed application was first exploited by Krabbe.

Among the plants which are killed by low temperatures above freezing point, the most delicately responsive are *Episcia discolor* Hook., *Sanchezia nobilis* Hook., *Eranthemum tricolor* Nichols., *E. couperi* Hook., *E. igneum* Linden., *Anæctochilus setaceus* Blume. The species in this list exhibit damage after exposure to temperatures 1.4° C. to 3.7° C. for periods of 18 to 100 hours. *Begonia stigmatosa*, *B. scandens*, *Bæhmeria argentea* Linden, *Tradescantia discolor*, *T. zebrina*, and *Euphorbia splendens*, *Ficus elastica*, *Gloxinia hybrida*, *Tropæolum majus*, are examples of a numerous class which are injured by longer exposure to the same temperature. It is to be seen that Molisch's carefully attained results sustain the contention of Goepfert and Müller-Thurgau that death from freezing is due to the formation of ice or to the direct influence of cold, and not to the processes of thawing as maintained by Sachs. The formation of ice entails the excretion of water from the protoplasm, and the great and rapid loss of the fluid results in the architectural disintegration of the plasma. The disintegration may be hastened by the poisonous action of concentrated cell-sap remaining.

So far as the results are at hand, it is to be said that the excretion of water by cells at low temperatures is not only a physical reaction, but this action has become under the direction of the protoplasm a protective adaptation. A second adaptation consists in the smallness of the cell.

D. T. MACDOUGALL.

#### SOCIETIES AND ACADEMIES.

##### BOSTON SOCIETY OF NATURAL HISTORY.

THE Society met December 1st; thirty-five persons present. Professor N. S. Shaler, in discussing Aeolian deposits in relation to the formation of river valleys, gave the result of his observations in Utah and Montana. Along the Ruby river, where the vegetation is dense and the soil rich, the loess is held and the valley built up. In Montana below 7,000 feet the vegetation is thin and insufficient to inhibit.

Mr. A. W. Grabau showed some fossils from the upper Devonian of western New York, and gave the views taken by various investigators as to the nature of Conodonts, since their discovery by Pander in the Silurian and Devonian

rocks of Russia. Mr. Grabau's studies confirm the position taken by Zittel and Rohon that these minute tooth-like fossils are the jaws of worms. He also discussed the relations of *Styliolina*, *Cardiola* and *Clymenia*, and the close parallelism between American and European Goniatites. Professor Hyatt took exception to Hinde's view, quoted by Mr. Grabau, as to the unity of the American and European forms; the late American faunas are residual; they do not originate types; the very ancient American faunas may be, however, originating faunas.

Dr. Jackson drew attention to the large numbers of associated fossils in very small space, and Mr. Grabau stated that Clark's investigations proved the identity of the American and European species.

SAMUEL HENSHAW,  
Secretary.

THE TORREY BOTANICAL CLUB, NOVEMBER 9,  
1897.

THE paper of the evening, by Mrs. E. G. Britton, a description of two new species of *Ophioglossum* will be printed in the *Bulletin*. The paper also discussed the affinities, range and type characters of our Eastern species of *Ophioglossum*, with keys and specific descriptions, and with exhibition of tracings and numerous mounted specimens.

Dr. Underwood sketched the characteristics of the four distinct types of *Ophioglossum* as: 1st, the section typified by *O. vulgatum* and discussed in the paper; 2d, that by *O. palmatum* of tropical America, which extends into Florida, there growing directly under the crown of the palmetto trees, nestled among the leaf-shrubs; 3d, that typified by *O. pendulum*, found in the Hawaiian Islands and Pacific regions, which is also pendulous from trees and produces a stipe attached almost to the middle of the leaf. In the 4th section, with growth not over one inch high, the sterile and fertile fronds are distinct to the rooting base.

Dr. Underwood further remarked the necessity of experience to discover forms of *Ophioglossum*, especially such as *O. croatillophoroides*, only one inch high, collected by him in Alabama.

Mr. Clute spoke of the great diversity in size displayed by *O. vulgatum* in a single locality.

Professor Burgess referred to the occasional occurrence of *O. vulgatum* with its own namesake *Pogonia ophioglossoides*, and to other companion-plants with which he finds *Ophioglossum* associated in growth, as *Chiogenes* and especially the orchids *Microstylis ophioglossoides*, *Habenaria hyperborea* and *H. dilatata*.

Dr. Underwood then exhibited photographs of the Kew Gardens, with reminiscences of his visit of last summer. He spoke particularly of their formal decoration, dating back to royal use, and the photographs shown included one of 'Queen Mary's Elm,' planted by her about 1555, once 25 feet in girth, now represented chiefly by a series of shoots.

EDWARD S. BURGESS,  
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of the Academy of Science of St. Louis on December 20, 1897, twenty-five persons present, Dr. R. J. Terry exhibited several specimens of human humerus, showing supracondylar process associated with high division of the brachial artery, which was contrasted with similar processes that have been observed in the anthropoid apes and the lower monkeys, and with a similarly situated foramen of the arm of the *Felidæ*. It was stated that while a slight roughness was observed, at the point indicated, in a majority of ninety-six specimens observed, the structure was fairly developed in four out of this number, in all cases on the left arm.

Professor F. E. Nipher presented a paper describing a long series of experiments made to determine the distribution of pressure over a pressure board, and summarizing the results reached.

WILLIAM TRELEASE,  
Recording Secretary.

NEW BOOKS.

*A Genealogy of Morals.* FRIEDRICH NIETZSCHE. Translated by WILLIAM A. HAUSEMANN. New York and London, The Macmillan Company. 1897. Pp. xix+289. \$2.

*The Social Mind and Education.* GEORGE EDGAR VINCENT. New York and London, The Macmillan Company. 1897. Pp. 146. \$1.25.

## SCIENCE.

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE.

Entered in the post-office at Lancaster, Pa., as second-class matter.

## TERMS OF SUBSCRIPTION.

Five dollars annually in advance: single copies 15 cents. Subscriptions and advertisements should be sent to SCIENCE, 41 North Queen Street, Lancaster, Pa., 66 Fifth Avenue, New York.

The first three volumes of the new series can be supplied for \$5.00 each, the fourth and fifth volumes for \$2.50 each. The publishers will pay 20 cents each for the numbers of Feb. 15, 22, July 26, Aug. 2, 1895; Jan. 31, 1896.

Published Weekly by

THE MACMILLAN COMPANY

## CONSTIPATION

IN ADULTS AND CHILDREN. With special reference to Habitual Constipation and its most successful Treatment by the Mechanical Methods.

By HENRY ILLOWAY, M.D.,

Formerly Professor of the Diseases of Children, Cincinnati College of Medicine and Surgery; formerly visiting physician to the Jewish Hospital, Cincinnati, etc.; Member of the Medical Society of the County of New York, of the New York County Medical Association, etc.

With many Plates and Illustrations.

Svo. Cloth. Price, \$4.00 net.

PUBLISHED BY

THE MACMILLAN COMPANY,  
66 Fifth Avenue, New York.

## THE AMERICAN HISTORICAL REVIEW

BOARD OF EDITORS—GEORGE B. ADAMS, Professor of History, Yale University, New Haven, Conn.; ALBERT BUSHNELL HART, Professor of History, Harvard University; HARRY PRATT JUDSON, Professor of Political Science, University of Chicago, Ill.; JOHN BACH McMASTER, Professor of American History, University of Pennsylvania, Philadelphia, Pa.; WILLIAM M. SLOANE, Seth Low Professor of History, Columbia University, New York; H. MORSE STEVENS, Professor of Modern History, Cornell University, Ithaca, N. Y.

MANAGING EDITOR—J. FRANKLIN JAMESON, Professor of History in Brown University, Providence, R. I.

Contents of Volume III., No. 1, October, 1897

HERBERT L. TUTTLE

FRED. M. FLING

HERBERT L. OSGOOD

MARY E. WOOLLEY

GEORGE H. HAYNES

DOCUMENTS—Ferdinand of Aragon to Diego Columbus, 1510; Letters of Christopher Gadsden, 1778;

Correspondence of Eli Whitney relative to the invention of the Cotton Gin

REVIEWS OF BOOKS—Maitland's *Domesday Book and Beyond*; Gardiner's *Cromwell's Place in History*;

Hubert's *La Torture aux Pays-Bas Autrichiens*; Lombroso's *Napoleone I. e l'Inghilterra*; Fisher's

*Evolution of the Constitution*; Buckley's *History of Methodism in the United States*; and other reviews

BIBLIOGRAPHICAL—A List of Printed Commissions and Instructions to Colonial Governors

NOTES AND NEWS

The Prussian Campaign of 1758, I.

Mirabeau, a Victim of the Lettres de Cachet

The Proprietary Province as a form of Colonial Government, II.

The Development of Love of Romantic Scenery in America

The Causes of Know-nothing Success in Massachusetts

Correspondence of Eli Whitney relative to the invention of the Cotton Gin

REVIEWS OF BOOKS—Maitland's *Domesday Book and Beyond*; Gardiner's *Cromwell's Place in History*;

Hubert's *La Torture aux Pays-Bas Autrichiens*; Lombroso's *Napoleone I. e l'Inghilterra*; Fisher's

*Evolution of the Constitution*; Buckley's *History of Methodism in the United States*; and other reviews

BIBLIOGRAPHICAL—A List of Printed Commissions and Instructions to Colonial Governors

NOTES AND NEWS

Single Number, \$1.00 Annual Subscription, \$3.00 Issued Quarterly Volumes I. and II., bound in half morocco, \$4.50.

Published by THE MACMILLAN COMPANY, 66 Fifth Avenue, New York City

## The Physical Review.

A JOURNAL OF EXPERIMENTAL AND THEORETICAL PHYSICS.

CONDUCTED BY

EDWARD L. NICHOLS, ERNEST MERRITT, AND FREDERICK BEDELL

XXVIII. October, 1897.

## TABLE OF CONTENTS.

The Discharge of Electrified Bodies by the X-Rays. CLEMENT D. CHILDS

The Surface Tension of Water and of Certain Dilute Aqueous Solutions, Determined by the Method of Ripples. II. N. ERNEST DORSEY

On the Use of the Interferometer in the Study of Electric Waves. G. F. HULL

Minor Contribution: On a Possible Change of Weight in Chemical Reaction. Fernando Sanford and Lillian E. Ray

Note: The American Association for the Advancement of Science.

New Books: J. Weisbach and G. Herrmann: The Mechanics of Pumping Machinery (Translated by K. P. Dahlstrom). F. J. Rogers: Deductive Physics.

Annual Subscription, \$5.00.

PUBLISHED FOR CORNELL UNIVERSITY.

THE MACMILLAN COMPANY,  
66 Fifth Avenue, New York.

Dec. 1, 1896. Just Published. Sixth Edition of

## THE MICROSCOPE AND MICROSCOPICAL METHODS.

By SIMON HENRY GAGE, Professor of Microscopy, Histology and Embryology in Cornell University and the New York State Veterinary College, Ithaca, N. Y., U.S.A.. Sixth edition, rewritten, greatly enlarged, and illustrated by 165 figures in the text. Price, \$1.50, postpaid.

COMSTOCK PUBLISHING CO., Ithaca, N. Y.



## For 12 Cents

I will mail a finely finished original photo. cabinet size, of Sioux Indian Chief, SITTING BULL, with his Signature. Have 200 subjects, all different, of leading Western Indians.

First-class work. Cabinet Size for 10 cents each. Some sent on selection. Give reference. After seeing sample you will want others. Indian Costume, Ornaments and Weapons. 15,000 Flint Stone Ancient Indian Relics. 100,000 Mineral and Fossil Specimens. Catalogue for stamp. 13th year.

L. W. STILWELL. Deadwood, South Dak.

# THE MACMILLAN COMPANY'S NEW SCIENTIFIC BOOKS

## Physical Science

**LIGHT, VISIBLE AND INVISIBLE.** By SYLVANUS P. THOMPSON, Professor of Physics in City and Guilds Technical College, London; Author of "Elementary Lessons in Electricity and Magnetism." 12mo. Cloth. Price, \$1.50.

SYLVANUS P.  
THOMPSON,  
London,  
England.

There is no text-book of "Elementary Lessons in Electricity and Magnetism" in such general use as a reference work in American Colleges as that prepared by Prof. SYLVANUS THOMPSON.

## Educational Science

**THE STUDY OF CHILDREN.** By Dr. FRANCIS WARNER, author of "A Course of Lectures on the Growth and Means of Training the Mental Faculties." Cloth. 16mo. Price, \$1.00.

FRANCIS  
WARNER, M.D.,  
London,  
England.

**THE SOCIAL MIND AND EDUCATION.** By Prof. GEORGE E. VINCENT, University of Chicago, Chicago, Ill. 18mo. Price, \$1.25.

GEORGE E.  
VINCENT,  
Chicago, Ill.

## Medical and Biological Science

**A SYSTEM OF MEDICINE.** By many Writers. Edited by THOMAS CLIFFORD ALLBUTT, M.A., M.D., LL.D., F.R.C.P., F.R.S., F.L.S., F.S.A., Regius Professor of Physic in the University of Cambridge. Vol. III. *Diseases of Obscure Causation, Alimentation, and Excretion.* Vol. IV. *Diseases of the Respiratory and the Circulatory Systems.* Sold by subscriptions only. 8vo, cloth, \$5.00 net. Half russa, \$6.00 net.

Edited by  
THOMAS C.  
ALLBUTT,  
University of  
Cambridge.

ROBERT  
WIEDERSHEIM.  
University of  
Freiburg-in-  
Baden, and  
W. N. PARKER,  
University of  
Wales.

**ELEMENTS OF THE COMPARATIVE ANATOMY OF VERTEBRATES.** Adapted from the German of Dr. ROBERT WIEDERSHEIM, Professor of Anatomy and Director of the Institute of Human and Comparative Anatomy in the University of Freiburg-in-Baden, by W. N. PARKER, Ph.D., Professor of Biology at the University College of South Wales and Monmouthshire in the University of Wales. Second Edition. (Founded on the Third German Edition.) With 333 Woodcuts and a Bibliography. 8vo, cloth, pp. xvi + 488, \$3.25 net.

**LECTURES ON THE ACTION OF MEDICINES.** Being the Course of Lectures on Pharmacology and Therapeutics delivered at St. Bartholomew's Hospital during the Summer of 1896. By T. LAUDER BRUNTON, M.D. (Edin.), author of "An Introduction to Modern Therapeutics," etc. 8vo. Cloth. Price, \$4.00 net.

T. LAUDER  
BRUNTON,  
M.D. (Edin.),  
LL.D. (Hon.)  
(Aber.), F.R.S.,  
etc.

**THE PRACTITIONER'S HANDBOOK OF TREATMENT; or, The Principles of Therapeutics.** By J. MILNER FOTHERGILL. 4th Edition. Edited by Wm. Murrill, M.D. 8vo. Cloth. Price, \$5.00 net.

J. MILNER  
FOTHERGILL,  
Edited by  
Wm. Murrill, M.D.

**CONSTIPATION IN ADULTS AND CHILDREN.** With special reference to Habitual Constipation and its Treatment by Mechanical Methods. By HENRY ILLOWAY, M.D., formerly Visiting Physician to the Jewish Hospital, Cincinnati. 8vo. Cloth. Price, \$4.00 net.

HENRY ILLOWAY,  
Formerly of the  
Cincinnati  
College of  
Medicine and  
Surgery.

## Books on Out-Door Life and Natural Science

**WILD NEIGHBORS.** A book about Animals. By ERNEST INGERSOLL. With 20 full-page Plates and other Illustrations. Crown 8vo, cloth. Price, \$1.50.

ERNEST  
INGERSOLL,  
New York.

**LIFE HISTORIES OF AMERICAN INSECTS.** By Prof. CLARENCE M. WEED, New Hampshire College of Agriculture and Mechanical Arts. With numerous Illustrations. Crown 8vo, cloth. Price, \$1.50.

CLARENCE  
M. WEED,  
N. H. College of  
Agriculture  
and  
Mech. Arts.

Like Mr. Ingersoll's book, valuable supplementary reading.

**NATURE STUDY IN ELEMENTARY SCHOOLS.** A Manual for Teachers. By Mrs. LUCY LANGDON WILLIAMS WILSON, Ph.D., Head of the Biological Laboratories in the Philadelphia Normal School for Girls. 12mo. Cloth. Price, 90 cents net.

Mrs. L. L. WILSON  
Normal School  
for Girls,  
Philadelphia.

**THE DAWN OF ASTRONOMY.** By J. NORMAN LOCKYER, F.R.S. A Study of the Temple Worship and Mythology of the Ancient Egyptians. New and Cheaper Edition. Extra 8vo. Price, \$3.00.

J. NORMAN  
LOCKYER.

THE MACMILLAN COMPANY, 66 Fifth Ave., New York



